



FOREST ANALYSIS BRANCH

Golden Timber Supply Area Analysis Report

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Preface

This report contains a timber supply analysis and a socio-economic analysis and is part of the provincial Timber Supply Review (TSR) carried out by the British Columbia Forest Service. The purpose of the review is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting in timber supply areas (TSAs) and tree farm licences (TFLs) throughout British Columbia.

To determine allowable timber harvesting levels, the chief forester must have an up-to-date assessment of the timber supply based on the best available information and reflecting current management direction. **The report that follows provides this assessment but should not be considered as a recommendation on permissible harvest levels.**

This report focuses on a single forest management scenario — current management practices. Current management practices are defined by the specifications in management plans for the timber supply area including guidelines for the protection of forest resources, the *Forest Practices Code (FPC) of B.C. Act* and official land-use decisions made by Cabinet.

Focussing the assessment on the implications of current practices rather than looking at a number of

different management regimes expedites the analysis process. An important part of these analyses is an assessment of how results might be affected by uncertainties — a process called sensitivity analysis. Together, the sensitivity analyses and the assessment of the effects of current forest management on the timber supply provide a basis for discussions among stakeholders about alternative timber harvesting levels.

In addition to having an up-to-date assessment of timber supply when setting the allowable annual cut (AAC) the chief forester considers short- and long-term implications of alternative harvest levels, capabilities and requirements of existing and proposed processing facilities, and the social and economic objectives of the Crown. The socio-economic analysis provides the chief forester with some of the information necessary for these considerations.

This report is second of four documents that will be released for each TSA as part of the timber supply review. (The first document is the data package). A third document called the public discussion paper summarizes the technical information and provides a focus for public discussions of possible timber harvest levels. The fourth outlines the chief forester's harvest level decision and the reasoning behind it.

Executive Summary

As part of the provincial Timber Supply Review, the British Columbia Forest Service has examined the availability of timber in the Golden Timber Supply Area (TSA). The analysis assesses how current forest management practices affect the supply of wood available for harvesting over the short- (next 20 years), medium- (21 years to 100 years from the present) and long- (beyond 100 years from the present) terms. It also examines the potential changes in timber supply stemming from uncertainties about forest growth and management actions. **It is important to note that the various harvest forecasts included in the report only indicate the timber supply implications of current practices and uncertainty. The forecasts are intended for discussion purposes only; they are not allowable cut (AAC) recommendations.**

The Golden Timber Supply Area (TSA) is located in southeastern British Columbia. Covering approximately 902 000 hectares, this timber supply area includes valley bottom lands in the Rocky Mountain Trench and the Columbia River Valley as well as adjacent rugged mountainous areas. Bordering the Golden TSA are five national parks. About 39% of the Golden TSA (approximately 351 000 hectares) is considered working forest managed by the Crown. Currently, about 56% of the working forest, or 17% of the total TSA, is considered available for timber harvesting under current forest management practices. These practices follow the standards and legislation set out by the *Forest Practices Code* and the objectives identified in the *Kootenay-Boundary Higher Level Plan Order*. Within the area available for timber harvesting, most of the forests are dominated by spruce, Douglas-fir and lodgepole pine, which are the tree species most commonly used by the forest industry in the area.

The results of this timber supply analysis suggest that the current allowable annual cut of 530 000 cubic metres can be maintained for the next 10 years while allowing for gradual and controlled changes in timber supply in the medium term, before achieving a stable long-term level.

The harvest level would have to be reduced by 10% after 10 years, and reduced again by 7.8% after 20 years, then maintained at 440 000 cubic metres per year for nine decades. After 11 decades the harvest level could be increased to the long-term level of 463 000 cubic metres per year, a level that is 12.6% lower than the current AAC.

These results reflect current knowledge and information on forest inventory, growth and management. However, uncertainty exists about several factors important in defining timber supply. A series of sensitivity analyses showed that these uncertainties could affect timber supply to varying degrees.

One alternative to the base case harvest forecast shows that it may be possible to increase the initial harvest level to 575 000 cubic metres per year by accepting a harvest flow that declines to a level 2.5% below the base case in the medium term. This alternative demonstrates the trade-off between short- and medium to long-term timber supply.

Short-term timber supply (over the next 20 years) in Golden TSA is very sensitive to some data and management changes. Changes in volume estimates for existing stands, land base size, minimum harvestable ages and forest cover requirements for caribou habitat caused large changes in short-term harvest levels. A 10% decrease in either land base or existing stand volumes would require an immediate reduction in the projected harvests.

For the medium term, the largest effects on projected harvests are associated with uncertainties in size of the timber harvesting land base, timber volumes for existing unmanaged stands, timber volumes for regenerated managed stands, site productivity, minimum harvestable ages (MHAs), allowable visual disturbance, landscape-level biodiversity and rules governing which stands are selected for harvesting.

For the long term, the largest effects are associated with uncertainties in timber volume estimates for regenerated managed stands, site productivity, size of the timber harvesting land base, the manner in which priorities are assigned to stands for timber harvesting, and forest cover requirements for mountain caribou.

Executive Summary

The timber supply analysis indicates that based on current inventory, growth and yield, and forest management information, timber harvests in the Golden TSA can be maintained at the current level for 10 years. The analysis indicates that several factors related to the current inventory, forest cover requirements and management regimes could affect timber supply; however, no conclusive evidence was available prior to the completion of this analysis to suggest that significant inaccuracies exist in the information used.

A socio-economic assessment indicates that the forest industry is the largest private sector source of basic income in the Golden TSA economy. The current level of harvesting supports an estimated

655 person-years of local employment annually (includes direct, indirect and induced jobs) and \$29.4 million in employment income. The 2003 socio-economic analysis for the Golden TSA indicates that the current AAC of 530 000 cubic metres per year, if fully harvested could support a total of approximately 859 person-years of local employment. Approximately 73% of the direct jobs are held by residents of the Golden TSA.

After the first decade, the reduction as shown in the base case forecast, could reduce the number of direct, indirect and induced jobs across the province by an estimated 140 person-years. As well, it could reduce annual provincial government revenues by approximately \$1.8 million in decade 2.

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Introduction

Timber supply* is the quantity of timber available for harvest over time. Timber supply is dynamic, not only because trees naturally grow and die, but also because conditions that affect tree growth, and the social and economic factors that affect the availability of trees for harvest, change through time.

Assessing the timber supply involves considering physical, biological, social and economic factors for all forest resource values, not just for timber. Physical factors include the land features of the area under study as well as the physical characteristics of living organisms, especially trees. Biological factors include the growth and development of living organisms. Economic factors include the financial profitability of conducting forest operations, and the broader community and social aspects of managing the forest resource.

All of these factors are linked: the financial profitability of harvest operations depends upon the terrain, as well as the physical characteristics of the trees to be harvested. Determining the physical characteristics of trees in the future requires knowledge of their growth pattern. Decisions about whether a stand is available for harvest often depends on how its harvest could affect other forest values, such as wildlife or recreation.

These factors are also subject to both uncertainty and different points of view. Financial profitability may change as world timber markets change. Unforeseen losses due to fire or pest infestations will alter the amount and value of timber. The appropriate balance of timber and non-timber values in a forest is an ongoing subject

of debate, and is complicated by changes in social objectives over time.

Thus, before an estimate of timber supply is interpreted, the set of physical, biological and socio-economic conditions on which it is based, and which define current forest management — as well as the uncertainties affecting these conditions — must first be understood.

Timber supply analysis is the process of assessing and predicting the current and future timber supply for a management unit (a geographic area). For a timber supply area (TSA)*, the timber supply analysis forms part of the information used by the chief forester of British Columbia in determining an allowable annual cut (AAC)* — the permissible harvest level for the area.

Timber supply projections made for TSAs look far into the future — 250 years or more. However, because of the uncertainty surrounding the information and because forest management objectives change through time, these projections should not be viewed as static prescriptions that remain in place for that length of time. They remain relevant only as long as the information upon which they are based remains relevant. Thus, it is important that re-analysis occurs regularly, using new information and knowledge to update the timber supply picture. This allows close monitoring of the timber supply and of the implications for the AAC stemming from changes in management practices and objectives.

**Throughout this document, an asterisk after a word or phrase indicates that it is defined in a box at the foot of the page, as well as in the glossary.*

Timber supply

The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.

Timber supply area (TSA)

An integrated resource management unit established in accordance with Section 7 of the Forest Act.

Allowable annual cut (AAC)

The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood per year.

Introduction

Timber supply analysis involves three main steps. The first is collecting and preparing information and data. The B.C. Forest Service forest inventory* plays a major role in this. The second step is using this data along with a timber supply computer model or models* to make projections or estimates of possible harvest levels over time. These projections are made using different sets of assumed values or conditions for the factors discussed above. The third step is interpreting and reporting results.

The following sections outline the timber supply analysis for the Golden TSA. Following a brief description of the area in Section 1, data preparation and formulation of assumptions are discussed in Section 2. Section 3 outlines the timber supply analysis methodology. Timber supply analysis results, are presented in Section 4. Section 5 examines the sensitivity of the results to uncertainties in the data and assumptions used, and is followed by a summary and conclusions in Section 6. Section 7 shows results of a socio-economic analysis for the Golden TSA. Appendixes A and B contain further details about the data and assumptions used in the analysis.

As part of the timber supply review, information is gathered on the short- and long-term implications of alternative harvest levels, and the capabilities and requirements of existing and proposed processing facilities. The socio-economic analysis provides information for the chief forester and the local

community to better understand the potential magnitude of impacts associated with any proposed harvest level changes.

The socio-economic analysis considers the current and projected levels of forestry activity associated with the Golden TSA within the context of regional timber supplies and production capacity. It does this by examining the profile of the region and the local forest industry; and assessing employment and income implications of the timber harvesting levels projected in the base case.

The analysis includes estimates of the employment and income impacts associated with timber supply analysis projections by three main sectors: harvesting and woodlands related activities, processing, and silviculture. Employment is measured in terms of person-years*. Employment income is calculated using average industry income estimates.

Data on direct employment, harvest levels, and fibre flows were obtained by surveying licensees and mill operators. The information was used to estimate harvesting, processing and silviculture direct employment averages associated with the harvest and the proportion of workers living in the area. The estimates of local and provincial harvesting, processing, and silviculture direct employment were then used to determine ratios of employment per 1000 cubic metres of timber harvested.

Forest inventory

An assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of other forest values such as recreation and visual quality.

Model

An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities.

Person-year(s)

One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years.

Introduction

Indirect and induced employment were calculated using the Golden TSA and provincial employment multipliers* developed by the Ministry of Finance. Indirect impacts result from direct businesses purchasing goods and services; induced impacts result from direct employees purchasing goods and services. Employment coefficients* per 1000 cubic metres were also determined for these indirect and induced impacts.

To estimate the level of employment that could be supported by alternative harvest rates, projected timber supply levels were multiplied by the calculated employment coefficients. It should be noted that employment coefficients are based on current productivity, harvest practices and management assumptions* and will not likely reflect industry conditions decades into the future. As such, the employment estimates should only be viewed as general indicators.

Employment multiplier

An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job.

Employment coefficient

The number of person-years of employment supported by every 1000 cubic metres of timber harvested; for example, a coefficient of 1.0 indicates that every 1000 cubic metres harvested supports one person-year, or 500 000 cubic metres supports 500 person-years.

Management assumptions

Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.

1 Description of the Golden Timber Supply Area

The Golden Timber Supply Area (TSA) lies in the mid-eastern part of British Columbia within the Southern Interior Forest Region (Figure 1). It is administered from the Columbia Forest District office in Revelstoke and satellite office in Golden bounded by the Revelstoke Timber Supply Area to the west, Robson Valley TSA to the north, the Invermere Timber Supply Area to the south, and the province of Alberta to the east. The Golden TSA is one of 15 timber supply areas in the Southern Interior Forest Region and comprises a total area of about 902 000 hectares. Bordering the TSA are five national parks and one provincial park; and within its borders is Cummins Provincial Park.

Some of these parks contribute to the TSA's management of biodiversity*, adding a further 283 000 hectares to the land base used in the timber supply analysis for the assessment of biodiversity. This expanded land base, totalling 1 185 000 hectares, is referred to as the Golden analysis area. The Golden analysis area coincides with the Golden Resource Management Zone of the *Kootenay-Boundary Higher Level Plan* Order (KBHLPO)*. It is subdivided into 29 landscape units (LU)* averaging around 41 000 hectares in size (Figure 2). Approximately 36% of the Golden analysis area is covered by productive forest. Spruce, Douglas-fir and pine are

the dominant tree species making up the productive forest.

The current allowable annual cut for the Golden TSA, effective in 2000, is 530 000 cubic metres per year. However, from 1998 to 2002, the average annual harvest has been 130 000 cubic metres per year less than the AAC.

The town of Golden is the major community within the Golden TSA. Forestry, recreation, railway operations and tourism are important sources of economic activity in the area.

The Golden TSA is located within the traditional territory of the Ktunaxa / Kinbasket Tribal Council and that of the Shuswap Nation Tribal Council.

1.1 The environment

The Golden TSA, located in southeastern British Columbia, is bounded by the Selkirk and Purcell Mountains to the west and the Rocky Mountains to the east.

Most of this TSA lies in the interior wet belt. The southern portion of the area has a drier climate, resulting in a greater proportion of Douglas-fir and lodgepole pine. Mountain peaks are covered by expanses of alpine tundra, rock and ice. Table 1 summarizes the biogeoclimatic zones* present, their location, the major tree species and other considerations such as climate and wildlife values.

Biodiversity (biological diversity)

The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.

Higher level plans

Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area.

Landscape unit

A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives.

Biogeoclimatic zones

A large geographic area with broadly homogeneous climate and similar dominant tree species.

1 Description of the Golden Timber Supply Area



Figure 1. Map of the Golden TSA area in relation to the Southern Interior Forest Region and province.

1 Description of the Golden Timber Supply Area

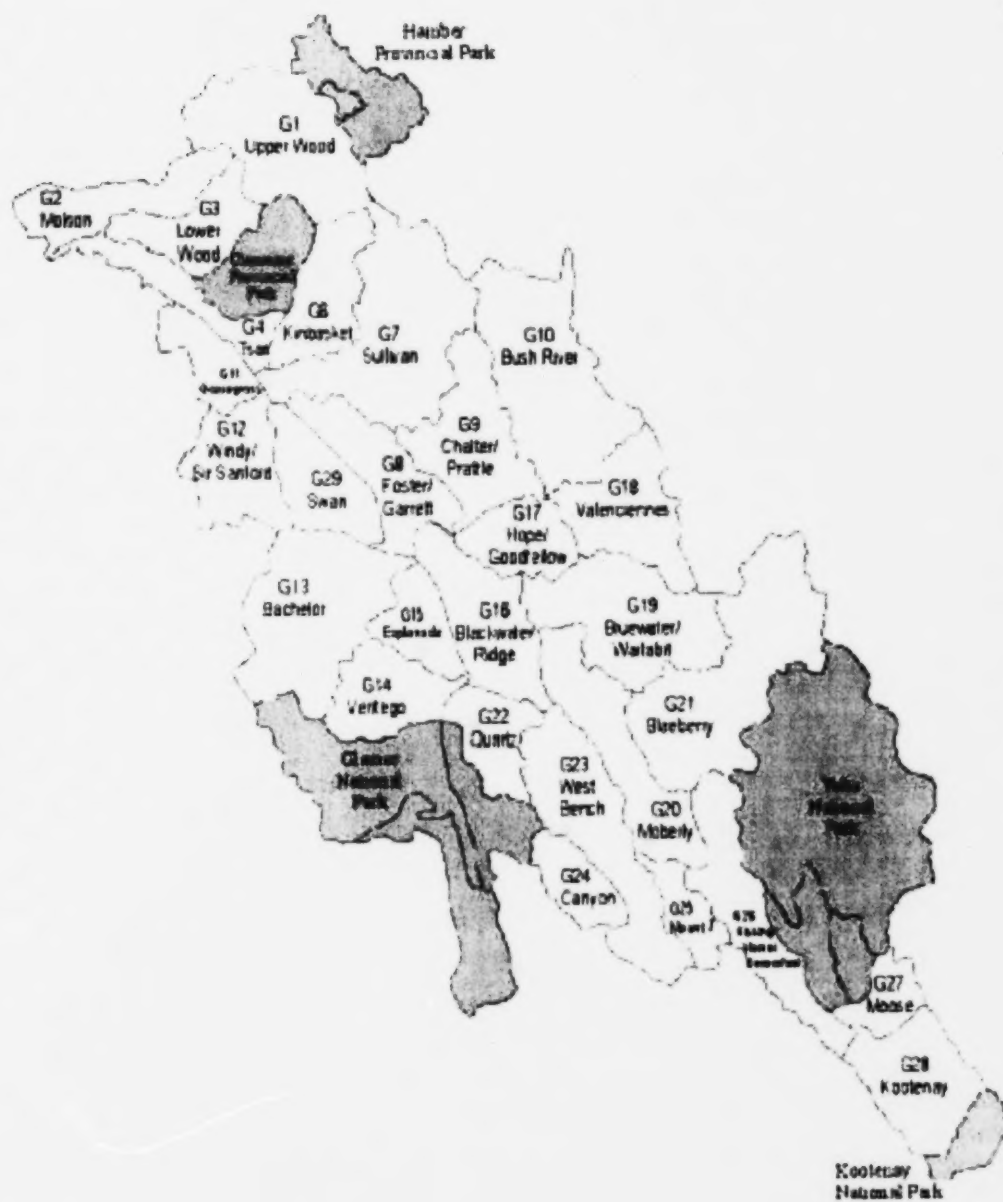


Figure 2. Map of the Golden analysis area landscape units.

1 Description of the Golden Timber Supply Area



Figure 2. Map of the Golden analysis area landscape units.

1 Description of the Golden Timber Supply Area

Table 1. Biogeoclimatic zones of the Golden timber supply area

Zone	Location	Tree species		Other
		Dominant	Minor	
Interior Cedar-hemlock	Occupies valley bottoms and lower slopes (below 1500 metres).	Western hemlock Western redcedar Douglas-fir	Lodgepole pine Western white pine Engelmann spruce Hybrid white spruce Subalpine fir	Cool winters with heavy snow; warm, dry summers. This is the most productive forest zone in interior B.C. and has the highest diversity of tree species of any B.C. zone. Wildlife constrained by deep winter snows.
Interior Douglas-fir	Limited occurrences in valley bottoms south of Golden.	Douglas-fir Lodgepole pine	Hybrid white spruce	Warm, dry summers, cool winters. Provides wide range of wildlife habitats.
Montane spruce	Above interior Douglas-fir and below Engelmann spruce-subalpine fir (1100 to 1600 metres).	Hybrid white spruce Lodgepole pine Subalpine fir	Douglas-fir	Moderately short, warm summers and cold, snowy winters. Most ungulates (except caribou) migrate to these lower elevations in winter.
Engelmann spruce-subalpine fir	Above interior Cedar-hemlock and Montane spruce, and below Alpine tundra (1500 to 2250 metres).	Engelmann spruce Subalpine fir	Lodgepole pine Whitebark pine Limber pine	Short, cool growing season. Long, cold winters with heavy snow. Wildlife constrained by deep snows and steep slopes.
Alpine tundra	Above Engelmann spruce-subalpine fir.	Treeless except for stunted forms at lower elevations of zone.		Cold, windy and snowy. Low growing season temperatures. Wildlife species and diversity low.

As a result of its mountainous terrain, the Golden timber supply area has a diverse forested environment that provides habitat for a wide variety of wildlife species. According to a 1992 inventory, approximately 274 bird, 63 mammal, 9 amphibian and 8 reptile species inhabit the area. Large mammal species include black and grizzly bear, moose, elk, mule deer, bighorn sheep and mountain goat. The northern part of the Golden TSA also overlaps the range of one of only three viable populations of mountain caribou in western Canada.

Wildlife species that live at high elevations or rely on young forests for habitat are generally

abundant. More than one-half of all species rely on low elevation habitats, including grasslands, wetlands and riparian forests. Animals that depend on the retention of mature forests include peregrine falcon, bald eagle, great blue heron, grizzly bear, caribou, fisher, cavity-nesting birds and small mammals. The majority of species that occur or potentially may be found in the Golden timber supply area, and that are considered at risk or regionally significant, are presented in Table 2. In addition, there are 14 rare plant communities that are either red or blue listed in the Columbia Forest District.

1 Description of the Golden Timber Supply Area

Table 2. Vulnerable, endangered, threatened and regionally significant species^a

Endangered or threatened (red-listed)	Vulnerable (blue-listed)	Regionally significant (yellow-listed)	
Northern long-eared myotis prairie falcon western grebe upland sandpiper northern leopard frog white sturgeon	Caribou fisher <i>Icterus</i> wolverine grizzly bear bighorn sheep (<i>canadensis</i>) southern red-back vole (<i>galei</i>) great blue heron short-eared owl American bittern turkey vulture American avocet sandhill crane flamulated owl trumpeter swan Lewis woodpecker painted turtle bull trout	mountain goat marten moose elk mule deer white-tailed deer Harlequin duck northern pygmy owl bald eagle Cooper's hawk eared grebe northern harrier pileated woodpecker	Vaux's swift Barrow's goldeneye common goldeneye northern goshawk (<i>atricapillus</i>) long-eared owl sharp-shinned hawk wood duck northern saw-whet owl black-chinned hummingbird bufflehead spotted frog

(a) B.C. Conservation Data Centre, June 1996.

Under the *Forest Practices Code**, a process exists for identifying species at risk and designating wildlife habitat areas (WHA) with specific

management practices. The wildlife species that have been identified within the Golden TSA are listed in Table 3.

Forest Practices Code

Legislation, standards and guidebooks that govern forest practices and planning, with a focus on ensuring management for all forest values.

1 Description of the Golden Timber Supply Area

Table 3. Columbia Forest District identified fish, birds and mammals

Common name of identified wildlife
Fish
bull trout
Birds
American bittern
northern goshawk
long-billed curlew
Mammals
Fisher
grizzly bear
mountain goat
bighorn sheep

Source: Managing Identified Wildlife, Volume 1, February 1999.

Note: An update of the standards, procedures and list of species is currently under development. This version is not yet available, but is scheduled to be published by fall 2003.

The timber supply analysis reflects the current forest management practices that follow the standards and legislation set out by the *Forest Practices Code (FPC)* and guidebooks. Government is preparing legislative amendments in the fall 2003 to allow for a transition between the existing *Forest Practices Code* and the new *Forest and Range Practices Act*, which is expected to be fully implemented in December 2005.

As well, several strategies described in the *Kootenay-Boundary Land Use Plan Implementation Strategy* are being implemented. These standards and strategies serve to manage for a range of critical biodiversity values, throughout the Golden TSA. Implementation of these guidelines aids in the maintenance of critical forest habitats for many species.

2 Information Preparation for the Timber Supply Analysis

Timber supply analysis requires three general categories of information: land base inventory; timber growth and yield; and management practices. These three categories are discussed below.

2.1 Land base inventory

Land base information used in this analysis came in the form of a computer file compiled in 2002 by the B.C. Forest Service. This file contains information on the forest land in Golden TSA and surrounding forest within the landscape units managed by the Columbia Forest District. The information includes general geographic location, area, nature of forest cover (such as presence or absence of trees, species, number of trees, age, and timber volume), and other characteristics such as environmental sensitivity and physical accessibility (operability*). Stand attributes such as tree height, stocking* and age have been projected to 2003. The inventory file has been updated to account for timber harvesting using Forest Development Plan (FDP) information and is current to December 2001.

The inventory file represents the land base for the entire TSA and its neighboring parks. It includes information on land that does not contain forest, and other areas where timber harvesting is not expected to occur, such as land set aside for parks, areas needed to protect wildlife habitat, areas in utility and transportation corridors, and residential and industrial development. A description of these categories of areas specific to

the Golden TSA is provided below. These areas do not contribute to the timber harvesting land base* of the Golden TSA. Before assessing timber supply, these non-contributing areas are identified and separated from the timber harvesting land base.

Areas that do not contribute to timber supply remain part of the Golden TSA. The B.C. Forest Service still manages the entire area of the TSA (except for designated areas under the jurisdiction of other agencies) as a land unit that contributes a mix of timber and non-timber values. The analysis described in this report reflects the diverse management regime used to support this mix of values.

This section describes the derivation of the timber harvesting land base. Use of the term timber harvesting land base in this report does not mean the area is open to unrestricted logging. Rather, it implies that forests in the area contain timber of sufficient economic value, and sites of adequate environmental resilience, to accommodate timber harvesting with due care for other resources. In addition, much of the forest outside of the timber harvesting land base helps to achieve objectives for non-timber forest values.

Operability

Classification of an area considered available for timber harvesting. Operability is determined using the terrain characteristics of the area as well as the quality and quantity of timber on the area.

Stocking

The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.

Timber harvesting land base

Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology.

2 Information Preparation for the Timber Supply Analysis

For the Golden TSA, the following types of areas were excluded from the timber harvesting land base.

- not managed by the province for timber supply purposes — these are non-Crown areas, such as private land and Indian Reserves, areas managed by other agencies such as parks and agricultural licences and land in woodlot licences* not administered as part of the TSA.
- non-vegetated, non-treed and sparsely treed land — areas not occupied by productive forest cover (e.g., rock, swamp, alpine areas and water bodies).
- inoperable areas* — areas classified as unavailable for harvest for terrain-related or economic reasons.
- environmentally sensitive areas (ESA)* — areas with sensitive soils or where there may be difficulty regenerating a new crop of trees.
- sites with low timber productivity — areas occupied by forest with insufficient volume at maturity to support economic harvesting, as demonstrated by Forest Development Plans.
- problem forest types (PFT) — areas occupied by forest types* currently considered not economic for harvesting because they contain too high a proportion of poor quality, low value timber species.
- existing unclassified roads — areas of forest land that have been removed from timber production due to access development and harvesting to date.
- riparian management areas — area unavailable for harvesting due to the need to provide protection for riparian and stream ecosystems.
- Stand-level biodiversity*, wildlife tree* patches (WTPs) — areas left within and along the sides of cutblocks* for the maintenance of stand structure. Valuable for the conservation of wildlife.

A more detailed description of these categories, including specific criteria for exclusion is located in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis." Table 3 summarizes the areas in each category, and shows the area of the timber harvesting land base. The column "Working forest area by classification" provides the total forested area managed by the B.C. Forest Service within the given category. For example, while there is a total of 2910 hectares of forested land classified as low productivity sites, 2733 hectares were excluded at that point of the land base determination. The difference arises because the actual area excluded depends on the sequence of the reduction (e.g., areas previously excluded as inoperable may have overlapped with low productivity stands, thus reducing the area explicitly excluded due to low productivity).

Woodlot licence

An agreement entered into under the Forest Act. It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis.

Inoperable areas

Areas defined as unavailable for harvest for terrain-related or economic reasons. Operability can change over time as a function of changing harvesting technology and economics.

Environmentally sensitive areas

Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches.

Forest type

The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples.

Stand-level biodiversity

A stand is a relatively localized and homogeneous land unit that can be managed using a single set of treatments. In stands, objectives for biodiversity are met by maintaining specified stand structure (wildlife trees or patches), vegetation species composition and coarse woody debris levels.

Wildlife tree

A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife.

Cutblock

A specific area, with defined boundaries, authorized for harvest.

2 Information Preparation for the Timber Supply Analysis

Table 3. Determination of the timber harvesting land base for Golden TSA

Classification	Working forest ^a area by classification	Area (hectares)	Per cent of total TSA area	Per cent of working forest area
Total Golden TSA area		902 445	100.0	
Not managed by the province for timber supply purposes		28 228		
Non-vegetated, non-treed and sparsely treed land ^b		522 767		
Total treed area managed by the province — working forest		351 450 ^c	38.9	100.0
Reductions to working forest:				
Inoperable	164 952	164 952		
Environmentally sensitive areas	7 440	6 238		
Low timber productivity	2 910	2 733		
Problem forest types	7 141	6 828		
Existing unclassified roads	3 376	3 057		
Riparian management areas	8 537	4 790		
Stand-level biodiversity (WTPs)	8 982	8 982		
Backlog not satisfactorily restocked (NSR)* land	8 933	3 762		
Timber licence reversions	5 067	3 938		
Total current reductions		205 280	22.7	58.4
Additions:				
Backlog NSR		3 762		
Timber licence reversions		3 938		
Total additions		7 700	0.9	2.2
Current timber harvesting land base		153 870	17.1	43.8
Future reductions				
Future roads		6 618	0.7	1.9
Future timber harvesting land base		147 252		

(a) Working forest denotes the Crown productive forest within the TSA. In this report, more general references to Crown productive forest relate to the entire Golden analysis area.

(b) Areas not occupied by productive forest cover.

(c) The total Golden analysis area covers 430 615 hectares of forest. Part of this area is outside the TSA in parks and protected areas (79 165 hectares)

Not satisfactorily restocked (NSR) areas

An area not covered by a sufficient number of well-spaced trees of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR.

2 Information Preparation for the Timber Supply Analysis

Management objectives for the Golden TSA may be affected by neighboring parks. For example, older forest requirements for landscape biodiversity are assessed on areas that straddle TSA and park boundaries. The TSA together with its neighboring

parks—the complete land base for landscape level biodiversity assessment—is referred to as the Golden analysis area. Table 4 shows the total area and the Crown forested area for the Golden analysis area.

Table 4. Golden analysis area, Crown forested portion

Land base	Area (hectares)
Golden TSA	902 445
Cummins Provincial Park	21 656
Hamber Provincial Park	25 338
Glacier National Park	87 682
Kootenay National Park	18 912
Yoho National Park	129 069
Total Golden analysis area	1 185 101
Crown forest within Golden TSA (working forest)	351 450
Crown forested portion of neighboring parks (for analysis of biodiversity contribution only)	79 165
Total Crown forest portion of the Golden analysis area	430 615

Note: Figures may not total due to rounding.

2 Information Preparation for the Timber Supply Analysis

Figure 3 represents the Golden TSA and its working forest land base. The total area chart shows that about 61% of the total land base is classified as not managed by the province of B.C., or as sparsely or non-treed land. The remaining 39% of the total land base is classified as working forest. The working forest chart details the categories of forest land and shows that about 56% of the working forest is considered unavailable for harvesting. The main reasons for unavailability are

physical or economic inoperability, wildlife tree patches (stand-level biodiversity) and problem forest types. Approximately 44% of the working forest is considered available for timber harvesting (including NSR and timber licences which have already been harvested and reverted to Crown ownership).

The current timber harvesting land base is 12 746 hectares (7.6%) smaller than in the last timber supply review due mainly to the updated classification of inoperability.

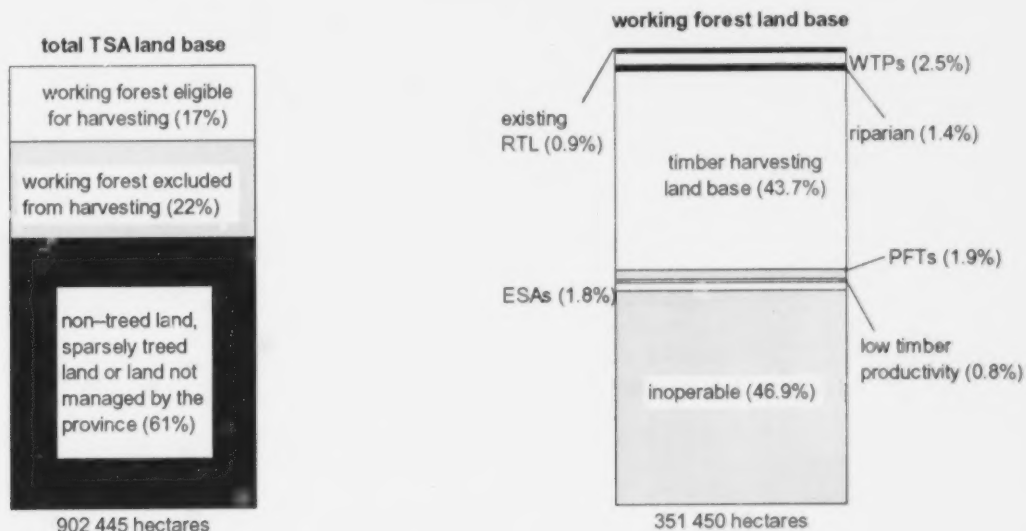


Figure 3. Composition of the total and working forest (Crown productive forest within the TSA) land bases — Golden TSA, 2003.

2 Information Preparation for the Timber Supply Analysis

Figure 4 shows the current composition of the timber harvesting land base by tree species group (For definitions of these groups refer to Appendix A, Table A-5., "Definition of analysis units"). Spruce dominates 35% of stands in the

timber harvesting land base, with Douglas-fir and pine dominating in 40%, cedar and hemlock in 17%, and subalpine fir (balsam), broad-leaf and unknown species in 8%.

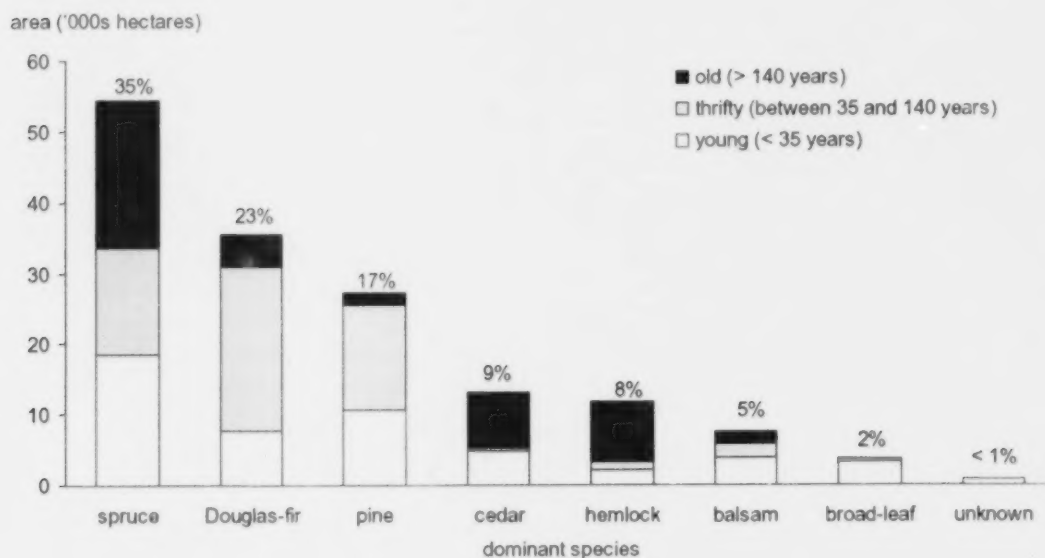


Figure 4. Area by dominant tree species and age classification — Golden TSA timber harvesting land base, 2003.

Figure 4 also shows the proportion of area for each species that consists of young stands (younger than 35 years), unmanaged thrifty, and old stands (over 140 years of age). In total, about 27% of stands in the timber harvesting land base have a

history of logging and subsequent management treatments; the other 73% of stands generally have not been harvested and therefore have no management history (refer to Appendix A, Table A-6., "Analysis unit statistics").

2 Information Preparation for the Timber Supply Analysis

Figure 5 provides an overview of the distribution of site productivity within the timber harvesting land base, and the relative amount of area in each class that is old, thrifty or young. Site productivity is classed as good, medium or poor based on site index (SI)*. Table A-5 "Definition of analysis units" in Appendix A describes the site

index ranges for each tree species and productivity class. Sites of very low productivity are excluded from the timber harvesting land base. About 20% of the sites in the timber harvesting land base are in the good productivity class, 60% in the medium class, and 20% in poor.

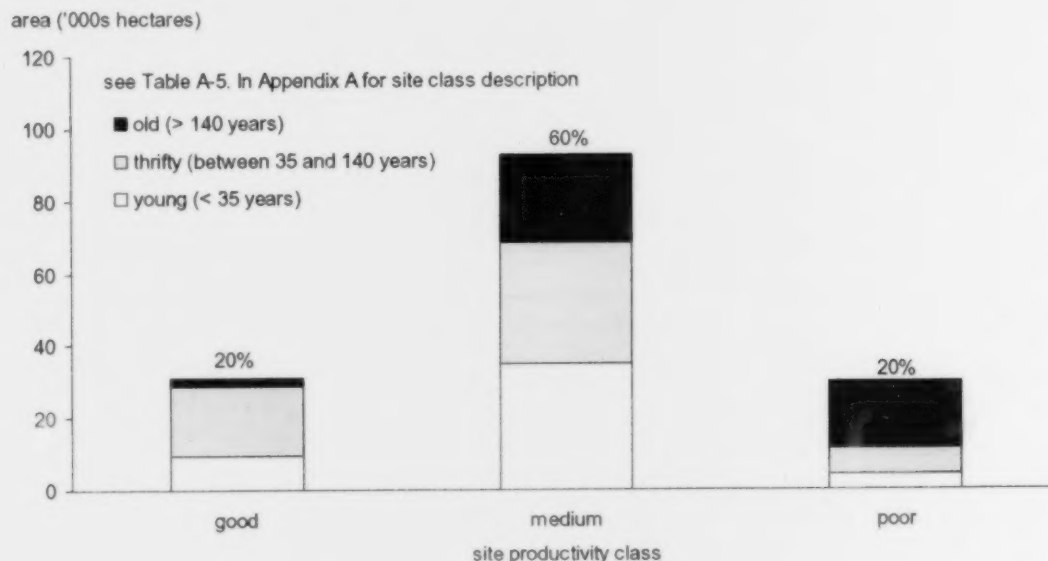


Figure 5. Area by site productivity class and age classification — Golden TSA timber harvesting land base, 2003.

Site index

A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground). Site index curves have been developed for British Columbia's major commercial tree species.

2 Information Preparation for the Timber Supply Analysis

Figure 6 shows the current age class distribution of forest stands on the current timber harvesting land base. Stands are grouped into 20-year age classes, except for the oldest stands.

About 30% of the total timber harvesting land base is occupied by stands over 140 years of age. The majority of stands older than 140 years of age are spruce, cedar or hemlock. Spruce stands tend to be younger than cedar and hemlock stands. Pine

stands are younger still, likely due to the frequency of fire where this species is common. Stands between the ages of 60 and 100 years occupy a significant portion of the timber harvesting land base and will reach their minimum harvestable age (MHA)* over the next 20 years. Currently, almost 47% of the stands in the timber harvesting land base are at or above their minimum harvestable age.

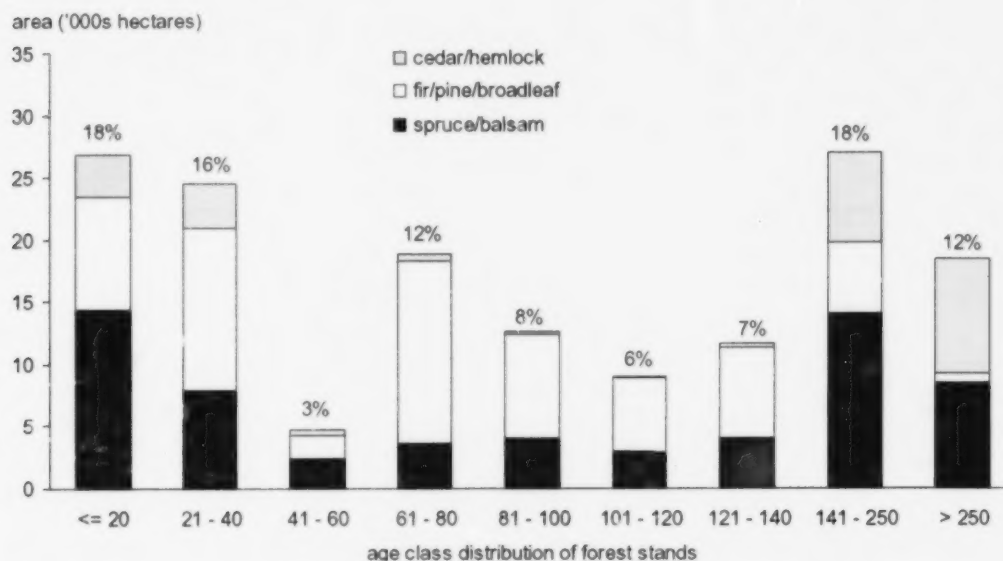


Figure 6. Current age class distribution — Golden TSA timber harvesting land base, 2003.

Minimum harvestable age

The age at which a stand of trees is expected to achieve a merchantable condition. The minimum harvestable age could be defined based on maximize average productivity (culmination of mean annual increment), minimum stand volume, or product objectives (usually related to average tree diameter).

2 Information Preparation for the Timber Supply Analysis

Figure 7 shows the current age composition of Crown forest covering all of the Golden analysis area. The Golden analysis area includes stands both inside and outside the TSA timber harvesting land base, as well as stands in adjacent parks and protected areas*. Although stands outside the timber harvesting land base do not contribute to any harvest schedule or harvest target, they do contribute to old forest targets for biodiversity and

wildlife habitat and; therefore, may affect the pattern and extent of harvesting within the Golden TSA. When compared to the timber harvesting land base, proportionately more of the total Golden analysis area is occupied by stands older than 140 years of age (30% versus 44%). Most of the landscape-level biodiversity* seral stage* objectives (old and mature plus old) within the Golden analysis area can be met by stands outside of the timber harvesting land base.

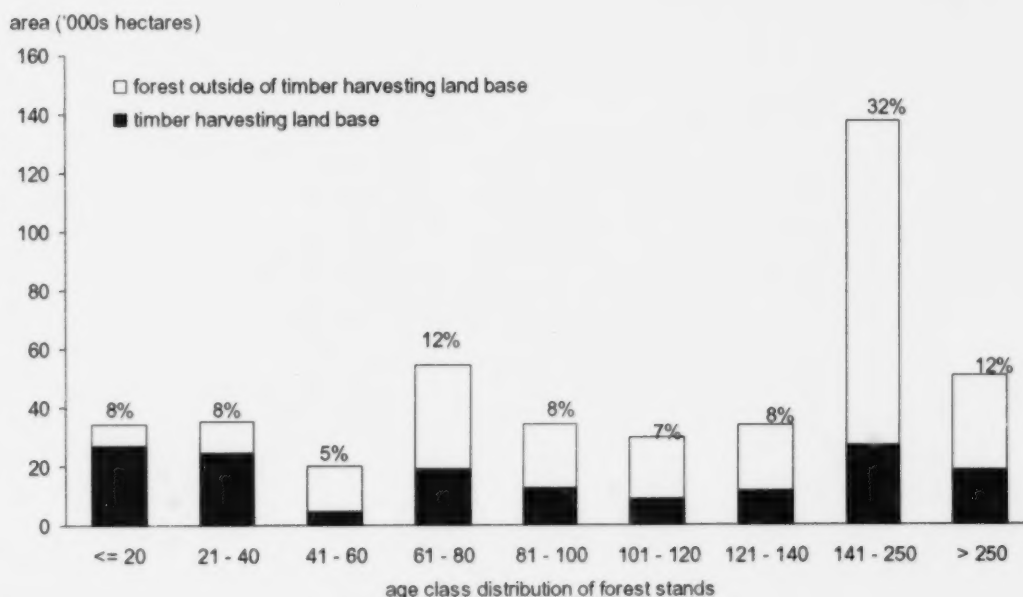


Figure 7. Current age class distribution — Golden analysis area Crown forested land base, 2003.

Protected area

A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations).

Landscape-level biodiversity

The Landscape Unit Planning Guide provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity.

Seral stages

Sequential stages in the development of plant communities that successively occupy a site and replace each other over time.

2 Information Preparation for the Timber Supply Analysis

Figure 8 and Table 5 depict the distribution of Crown forested land base within the Golden analysis area relative to the biogeoclimatic ecosystem classification (BEC) system. They also identify the portion of the Crown forested land base within each BEC category within the timber harvesting land base. This portion is significant because landscape-level biodiversity requirements can be met by areas outside of the timber harvesting

land base if there is a sufficient amount of suitable forest area. Where there is an inadequate area outside of the timber harvesting land base, biodiversity objectives affect timber supply more, since some forest within the timber harvesting land base must be reserved from harvest. Landscape-level biodiversity requirements are specified at the landscape unit scale and vary with natural disturbance type (NDT)* and biogeoclimatic variant*.



Figure 8. Distribution of Crown productive forest by biogeoclimatic variant – Golden analysis area, 2003

Natural disturbance type (NDT)

An area that is characterized by a natural disturbance regime, such as wildfires, which affects the natural distribution of seral stages. For example areas subject to less frequent stand-initiating disturbances usually have more older forests.

Biogeoclimatic (BEC) variant

A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.

2 Information Preparation for the Timber Supply Analysis

Figure 8 and Table 5 depict the distribution of Crown forested land base within the Golden analysis area relative to the biogeoclimatic ecosystem classification (BEC) system. They also identify the portion of the Crown forested land base within each BEC category within the timber harvesting land base. This portion is significant because landscape-level biodiversity requirements can be met by areas outside of the timber harvesting

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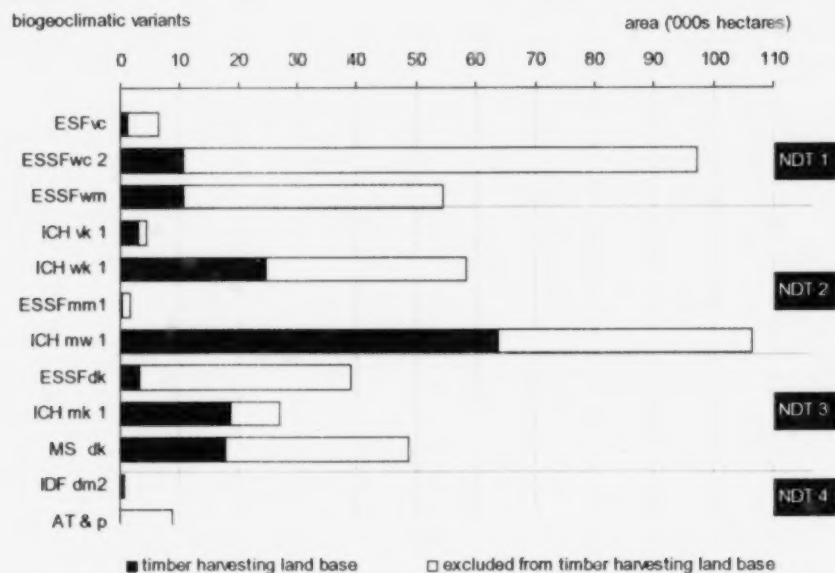


Figure 8. Distribution of Crown productive forest by biogeoclimatic variant — Golden analysis area, 2003.

Natural disturbance type (NDT)

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Biogeoclimatic (BEC) variant

A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.

2 Information Preparation for the Timber Supply Analysis

Table 5. Crown forest and timber harvesting land base by biogeoclimatic ecosystem variant — Golden analysis area, 2003.

NDT	BEC variant	Crown forest (hectares)	Per cent (%) of Crown forest in variant	Timber harvesting land base (hectares)	Per cent (%) of timber harvesting land base in variant	Per cent (%) of Crown forest in each variant that is in the timber harvesting land base
1	ESSFvc	6 070	1	1 124	1	19
	ESSFwc2	89 538	21	10 578	7	12
	ESSFwc4	29	0	0	0	0
	ESSFwm	51 160	12	10 632	7	21
	ICHvk1	4 454	1	3 070	2	69
	ICHwk1	55 417	13	24 776	16	45
1		206 668	48	50 180	33	
2	ESSFmm1	1 404	1	127	0	9
	ICHmw1	106 150	25	63 711	41	60
2		107 554	25	63 838	41	
3	ESSFdk	34 418	8	3 186	2	9
	ICHmk1	26 929	6	18 628	12	69
	MSdk	48 458	11	17 698	12	37
3		109 805	26	39 512	26	
4	IDFdm2	707	0	336	0	48
5	AT and sub-alpine parkland	5 881	1	4	0	0
	All	430 615		153 870	100%	

2 Information Preparation for the Timber Supply Analysis

2.2 Timber growth and yield

Timber growth and yield refers to the prediction of the growth and development of forest stands over time. Forest stands have many characteristics that change over time (for example, number of trees per hectare, tree diameter, tree height, species composition). Since timber supply analysis concentrates on timber volumes available over time, the most relevant measure for this analysis is volume per unit area (in British Columbia, cubic metres per hectare). An estimate of timber volume in a stand assumes a specific utilization level, or set of dimensions, that establish the minimum tree and log sizes that are removed from a site. Utilization levels used in estimating timber volumes specify minimum diameters both near the base and the top of a tree.

Two growth and yield models were used to estimate timber volumes for the Golden TSA analysis. The variable density yield prediction (VDYP)* model supported by the Ministry of Sustainable Resource Management, Terrestrial Information Branch, was used for estimating timber volumes for all existing natural stands and all coniferous* stands that will be harvested in the future by partial harvesting. The

table interpolation program for stand yields (TIPSY)*, developed by the B.C. Forest Service, Research Branch was used to estimate timber volumes for both existing and future managed stands. All existing coniferous stands less than 26 years old and coniferous stands that will be harvested and regenerated in the future were assumed to grow according to managed stand volume estimates* from TIPSY.

Uncertainty in volume estimation and prediction may result from uncertainty in the inventories that form the inputs for growth and yield models, from variability around the average estimates provided by growth and yield models, from limited experience with second-growth in British Columbia, and from the long-time frame over which trees grow. Sensitivity analyses described in Section 5, "Timber Supply Sensitivity Analyses," address the possibility that actual timber volumes may be different from estimates used in this analysis.

Based on timber volume estimates, the current timber inventory or growing stock* on the timber harvesting land base is approximately 30.7 million cubic metres. Most of this growing stock (about 26.6 million cubic metres, or 86.6% of the total) is currently merchantable; that is, in stands older than minimum harvestable age.

Variable Density Yield Prediction model

An empirical yield prediction system supported by the Ministry of Sustainable Resource Management, designed to predict average yields and provide forest inventory updates over large areas (i.e., Timber Supply Areas). It is intended for use in unmanaged natural stands of pure or mixed species composition.

Coniferous

Coniferous trees have needles or scale-like leaves and are usually 'evergreen'.

Table Interpolation Program for Stand Yields

A B.C. Forest Service computer program used to generate yield projections for managed stands based on interpolating from yield tables of a model (TASS) that simulates the growth of individual trees based on internal growth processes, crown competition, environmental factors and silvicultural practices.

Volume estimates (yield projections)

Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands.

Growing stock

The volume estimate for all standing timber at a particular time.

2 Information Preparation for the Timber Supply Analysis

2.3 Management practices

Timber supply depends directly on how the forest is managed for both timber and non-timber values. Therefore, levels of management activity must be defined for the timber supply analysis process. The *Kootenay-Boundary Higher Level Plan Order* and the *Forest Practices Code of British Columbia Act* guide forest management practices in the Golden TSA, and are reflected in the analysis. The focus of the timber supply review is to assess timber supply based on current management practices as implemented in plans for the area. Staff in the Columbia Forest District provided descriptions for the following management practices:

- Silviculture practices — reforestation activities required to establish free-growing* stands of acceptable tree species. Approximately 15% of coniferous areas in the Golden TSA are harvested using a partial harvesting system. Other areas are harvested using the clearcut system. All areas are restocked by planting.
- Forest health and unsalvaged losses* — timber losses to fire, windthrow, insects and diseases are expected to average 7627 cubic metres per year. This amount has been subtracted from all harvest forecasts* shown in this report.
- Utilization levels — minimum sizes of trees, and logs to be removed during harvesting. See Table A-16, "Utilization levels" in Appendix A.
- Minimum harvestable ages — the time it takes for stands to grow to a merchantable condition. In most cases, minimum harvestable ages were defined as the age at which a stand reaches a minimum merchantable volume, a minimum diameter and 95% of the culmination mean annual increment (MAI)*. Actual harvest ages may be greater but not less than the minimum, and will depend on ages of other available stands, forest cover objectives* and overall timber harvest targets.

Free-growing

An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.

Unsalvaged losses

The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested.

Harvest forecast

The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized over time for a specified land base and set of management practices. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.

Forest cover objectives

Specify desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives. General adjacency and green-up guidelines are also specified using forest cover objectives (see Cutblock adjacency and Green-up).

Mean annual increment (MAI)

Stand volume divided by stand age. The age at which average stand growth, or MAI, reaches its maximum is called the culmination age (CMAI). Harvesting all stands at this age results in a maximum average harvest over the long term.

2 Information Preparation for the Timber Supply Analysis

- **Cutblock adjacency* and green-up*** — in the Golden TSA, approval of harvesting activities is contingent on previously harvested stands reaching a desired condition, or green-up (2.5 metres in height) before adjacent stands may be harvested. The purpose of the cutblock adjacency guidelines is to prevent timber harvesting from becoming overly concentrated in an area at any time. To approximate the effect of cutblock adjacency, a maximum of 25% the integrated resource management (IRM)* portion of the timber harvesting land base was allowed to be below green-up condition at any time within each landscape unit.
- **Maintenance of ungulate* winter range** — retaining suitable cover for winter habitat. At most 25% of an ungulate winter range (UWR) area may be covered by stands less than 2.5 metres tall, and 40% of a winter range area is to be maintained in stands older than 100 years of age.
- **Management of caribou habitat** — maintenance of specific caribou habitat types is required in the Golden analysis area. Caribou habitat areas are divided in components based on the ICH and ESSF biogeoclimatic zones in order to distribute the harvest and provide habitat in both zones. For caribou habitat below the 1994 operability line, at least 40% of the area must be covered by stands older than 140 years, and at least 10% of this same area must be covered by stands older than 250 years. Furthermore, at most 25% of the area may be covered by stands less than 2.5 metres tall. For caribou habitat above the 1994 operability line, at least 70% of a habitat area must be covered by stands older than 140 years and at most 25% of the area may be covered by stands less than 2.5 metres tall. Only area having a slope of less than 80% is considered for the forest cover objectives for caribou habitat.
- **Maintenance of scenic values** — maintaining important scenic values requires that visible evidence of harvesting must be kept within limits in some areas of the Golden TSA. The maximum proportion of each scenic area* that may be less than the visually effective green-up (VEG) height varies depending on the forest characteristics and the visual quality class (VQC) for each area, but generally ranges between 1% and 15%. The VEG height was 6 metres for all visual quality classes.
- **Domestic watersheds*** — maintaining forest cover to maintain water quality and quantity and to prevent soil erosion. At most 25% of each domestic watershed may be covered by stands less than 6 metres tall. There are no community watersheds in the Golden TSA.
- **Ungulate winter range, caribou habitat, scenic and domestic watershed areas overlap in many places.** More than one forest cover objective may be applied to an area as a result.

Cutblock adjacency

The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions.

Green-up

The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas.

Integrated resource management (IRM)

The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making.

Ungulate

A hoofed herbivore, such as deer.

Scenic area

Any visually sensitive area or scenic landscape identified through a visual landscape inventory or planning process carried out or approved by a district manager.

Watershed

An area drained by a stream or river. A large watershed may contain several smaller watersheds.

2 Information Preparation for the Timber Supply Analysis

- Landscape-level biodiversity — to maintain biological diversity, each landscape unit and biogeoclimatic ecosystem classification (BEC) variant is required at all times to have a specified minimum amount of forested area in stands with old forest characteristics. The amount of old forest required depends on the natural disturbance type (NDT) associated with each BEC variant.

More detailed descriptions of these management practices and the assumptions used to assess their impacts on timber supply are included

in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis."

Figure 9 shows the distribution of the timber harvesting land base by management emphasis. The integrated resource management (IRM) zone accounts for 52% of the timber harvesting land base and wildlife habitat (caribou and other ungulates) accounts for 36%. Visual quality objectives (VQOs)* apply to 13% of the timber harvesting land base. Domestic watersheds cover less than 4% of the timber harvesting land base.

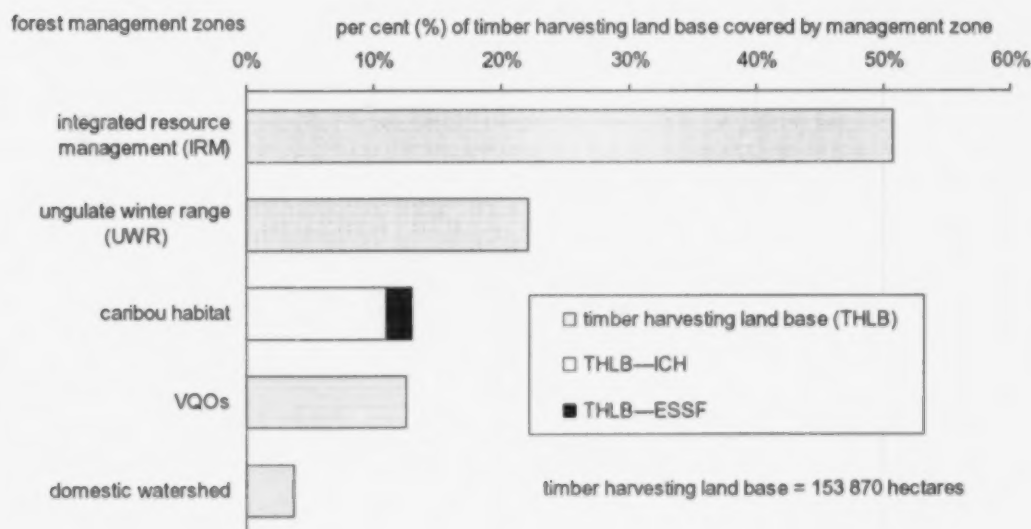


Figure 9. Area by management emphasis — Golden TSA timber harvesting land base, 2003.

The percentages total to more than 100% because management areas overlap. Information on the overlap of management emphasis areas and the

details on the area associated with each can be found in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis."

Visual quality objective (VQO)

Defines a level of acceptable landscape alteration resulting from timber harvesting and other activities. A number of visual quality classes have been defined on the basis of the maximum amount of alteration permitted.

3 Timber Supply Analysis Methods

The purpose of this analysis is to examine both the short- and long-term timber harvesting opportunities in the Golden TSA under current forest management practices. A timber supply computer simulation model developed by the B.C. Forest Service (FSSIM version 4.1) was used for the analysis. A timber supply model, as distinct from a growth and yield model, assists the timber supply analyst in determining how an entire forest (collection of stands) could be managed to obtain a harvest forecast (supply of timber over time). The simulation model uses information about the timber harvesting land base, timber volumes, and the management regime to represent how forests grow and are harvested over hundreds of years. Generally, only the results for the first 250 years are shown graphically in this report because the projected harvest remains constant after that time.

Similar to other models, the B.C. Forest Service model assumes that trees grow according to specified yield projections and are harvested according to either a volume target or a specified objective set by the analyst. The Forest Service model also allows the use of forest cover guidelines that specify the desired age composition of the forest. These guidelines can be used to examine the effects of cutblock adjacency and green-up

prescriptions. For example, guidelines might specify that no more than some maximum percentage of the forest can be younger than a specified green-up age, or that some minimum percentage of the forest must be in older age classes to provide wildlife habitat. The B.C. Forest Service simulation model facilitates examination of the effects of such guidelines on timber supply.

This type of analysis is used to determine the timber supply implications of a particular management regime. The results of the analysis are especially important in determining allowable cuts that will not restrict options of future resource managers, and that will assist local B.C. Forest Service staff to administer their programs according to relevant guidelines and principles. However, the results of the analysis are not meant to be taken as recommendations of any particular AAC.

The main results of the analysis are forecasts of potential timber harvests and timber inventory changes (ages and volumes) over time. Although this information gives field staff only very limited guidance in the design of operational activities such as harvesting block location and silviculture planning, it does help ensure that the timber harvest level supports rather than hinders sustainable forest management in the field.

4 Results

This section provides the results of timber supply analysis for the Golden TSA. The base case harvest forecast* uses the most recent assessments of current forest management, the land available for timber harvesting and timber yields as described in Section 2, "Information Preparation for the Timber Supply Analysis." The impacts of uncertainty in the inputs to the analysis will be discussed in Section 5, "Timber Supply Sensitivity Analyses." It is important to keep in mind that the base case provides only part of the timber supply picture for the Golden TSA, and should not be viewed in isolation of the sensitivity analyses.

4.1 Base case harvest forecast

The base case harvest forecast for the Golden TSA incorporates current management as described in various sections of Appendix A of this report.

Several principles were considered when developing the base case forecast. One consideration was to maintain the current AAC for as long as possible while ensuring a controlled and gradual decline in harvest levels during the transition of harvesting from existing old stands to managed second growth. Secondly, short-term harvest levels should not cause abrupt disruptions in medium- or long-term supply. The long-term level was set at the highest possible level that was sustainable over the long-term, signified by a stable long-term growing stock.

During the analysis, timber supply forecasts were made for 400 years to ensure the stability of long-term projections. However, only the results for a 250-year horizon are shown, since the projections are constant after that time.

Base case harvest forecast

The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.

4 Results

Figure 10 shows the base case harvest forecast for the Golden TSA. The harvest forecast in the first decade is 530 000 cubic metres per year, which is the current AAC. It declines by 10% after the first decade, and declines again by 7.8% after the

second decade, where it stabilizes at 440 000 cubic metres per year for a period of nine decades. After the eleventh decade the harvest forecast rises to the long-term harvest level* of 463 000 cubic metres per year, a level 12.6% lower than the current AAC.

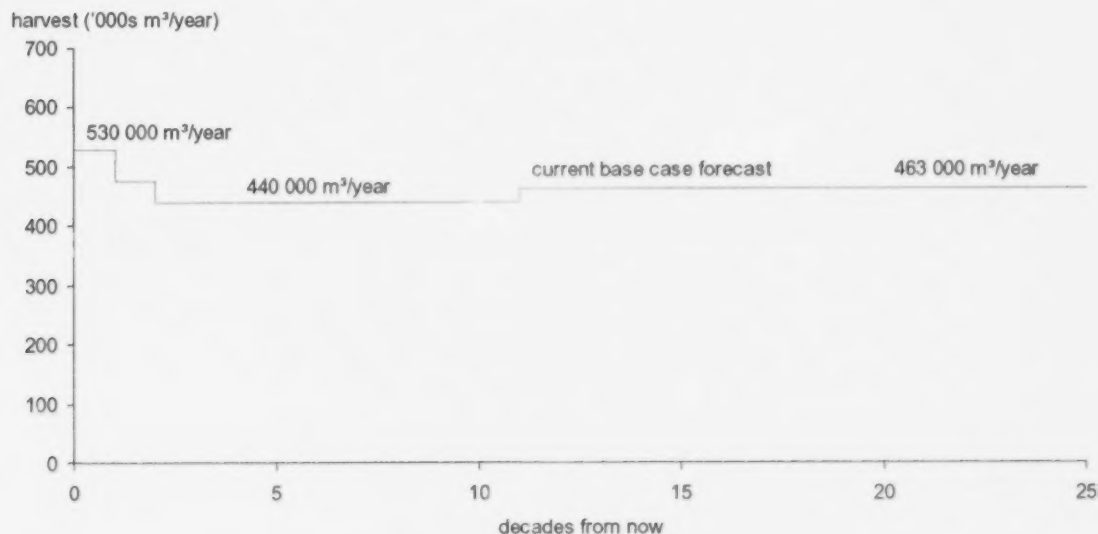


Figure 10. Base case harvest forecast — Golden TSA, 2003.

Unsalvaged losses to natural forces such as insects, fire and wind throw are estimated to be 7627 cubic metres per year for the entire 250-year

horizon, and have been subtracted from all harvest forecasts shown in this report.

Long-term harvest level

A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.

4 Results

4.2 Base case harvest characteristics

Figure 11 shows the transition of harvesting from existing to managed stands, and the amount that each makes up in the base case forecast. The transition to managed stands begins in decade 6 and is almost complete by decade 12. Natural stands continue to contribute to the harvest between

decades 12 and 20 as managed stands become old enough to replace them for meeting other resource values. After decade 20 few natural stands contribute to the base case harvest forecast.

The small amount of managed-stand harvest in the first decade consists of deciduous*-leading mixed stands within the FDP whose growth is being projected using a managed stand growth and yield model.

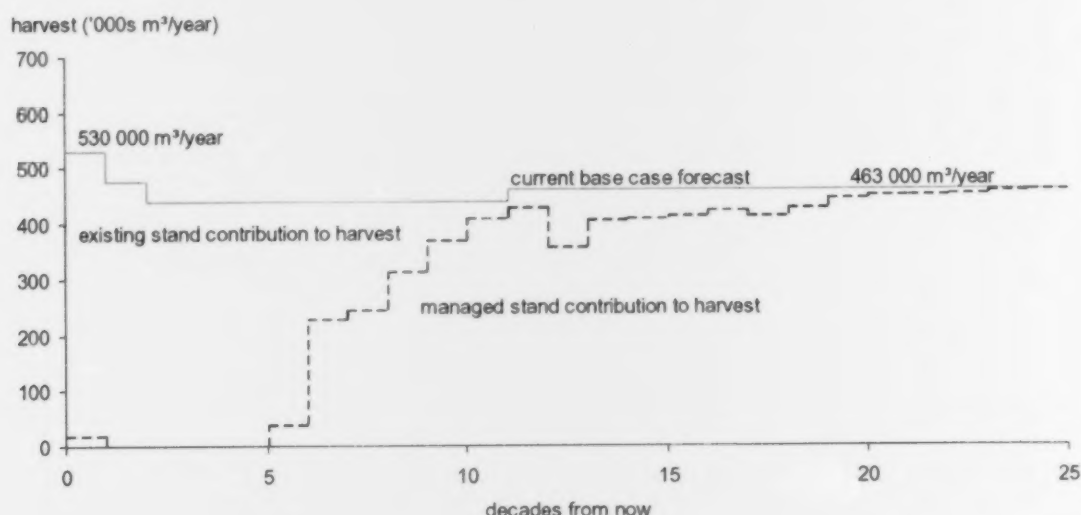


Figure 11. Harvest contribution from existing and managed stands — Golden TSA, 2003.

Deciduous

Deciduous trees shed their leaves annually and commonly have broad-leaves.

4 Results

Historically the major licensees have favored operating in the southern part of Golden TSA due to better access and proximity to processing facilities. Harvests have been concentrated in the south as a result. In the future a greater portion of the harvest will need to come from the northern part of the TSA, which includes landscape units 1 through 12 and 29, and accounts for 29.1% of the timber harvesting land base. The heavy dashed line in

Figure 12 indicates the volume contribution to the base case harvest forecast from the north. For the first two decades about 45% of the harvest forecast is obtained from the north. After decade 2, the contribution from the north drops off for a period of 7 decades, averaging 20% over that time. Over the entire 250-year period the north contributes 26.6% on average to the base case harvest forecast.

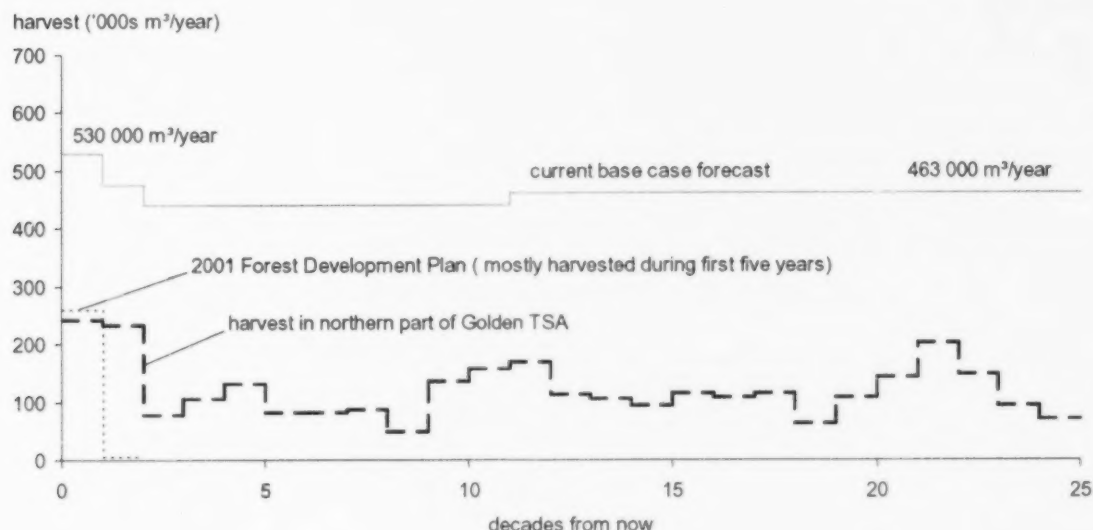


Figure 12. Harvest contribution by selected geographic area — Golden TSA, 2003.

In the first decade, areas proposed for harvest in forest development plans (FDPs) throughout Golden TSA are given first priority for harvesting. The dotted line in Figure 12 indicates the volume contribution to the base case harvest forecast from

FDPs. During the first five years of the harvest forecast about 82% of the harvest volume is obtained from FDP areas. When averaged over the first ten years just under 50% of the harvest is obtained from FDP areas.

4 Results

Figure 13 shows the average annual area harvested and the average volume yield by decade over the 250 years of the base case forecast. The area harvested is projected to average 1437 hectares per year, ranging from a maximum of 1611 hectares per year in the fourteenth decade, to a minimum of

1136 hectares per year in decade 4. The average volume yield of 326 cubic metres per hectare, ranges from a peak of 394 cubic metres per hectare in the fourth decade to a low of 292 cubic metres per hectare in decade 14.

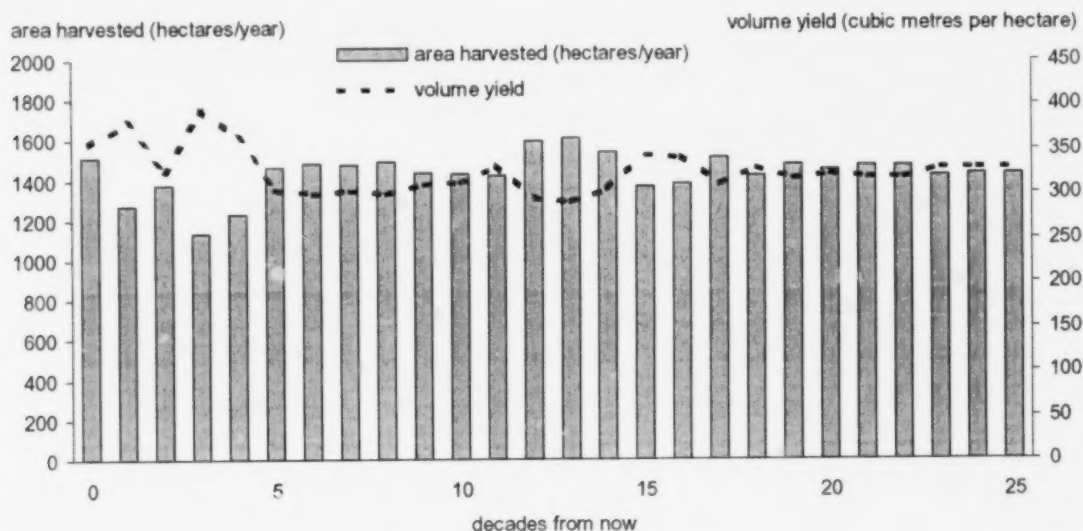


Figure 13. Average annual area harvested and volume yield — Golden TSA base case, 2003.

4 Results

Figure 14 shows the average area harvested by silvicultural system. The clearcutting method is the system predominately used throughout Golden TSA. However, partial harvests occur where stands are susceptible to beetle infestation.

Under a 'beetle proofing' harvest regime, partial cutting (first entry) generally removes 50% of a stand's volume 20 years or more before clearcutting (final entry) is scheduled.

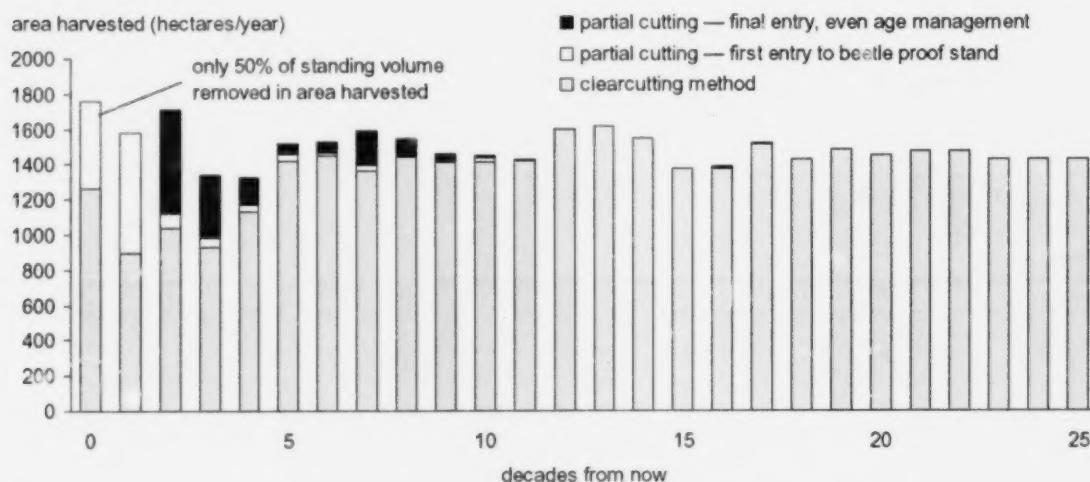


Figure 14. Average area harvested by silvicultural system — Golden TSA base case, 2003.

Approximately 35% of the area harvested during the first two decades is partially cut. After decade two few stands identified in the base case for partial cutting remain, and thus the amount of area partially cut falls off. The significant amount of partial harvesting forecast over the next four decades, together with the priority placed on the

Forest Development Plan, are responsible for the fluctuations in the areas and volume hectares harvested as shown in Figure 13. For example, the final entry partial harvesting in the third period decreases average per hectare yields, thereby increasing the area harvested relative to the previous period.

4 Results

Figure 15 shows the average age of stands harvested over time. During the first three decades of the base case forecast stands proposed for harvesting in forest development plans, and stands in the partial cutting zone have priority for harvesting and get harvested first. After decade 3 older stands not constrained by forest cover

objectives have priority for harvesting and comprise a larger portion of the harvest resulting in a steep rise in the average harvest age. After decade 4 the average harvest age generally declines as a result of the transition from harvesting old existing stands to harvesting younger managed stands. After decade 10 the average harvest age stabilizes at around 91 years.

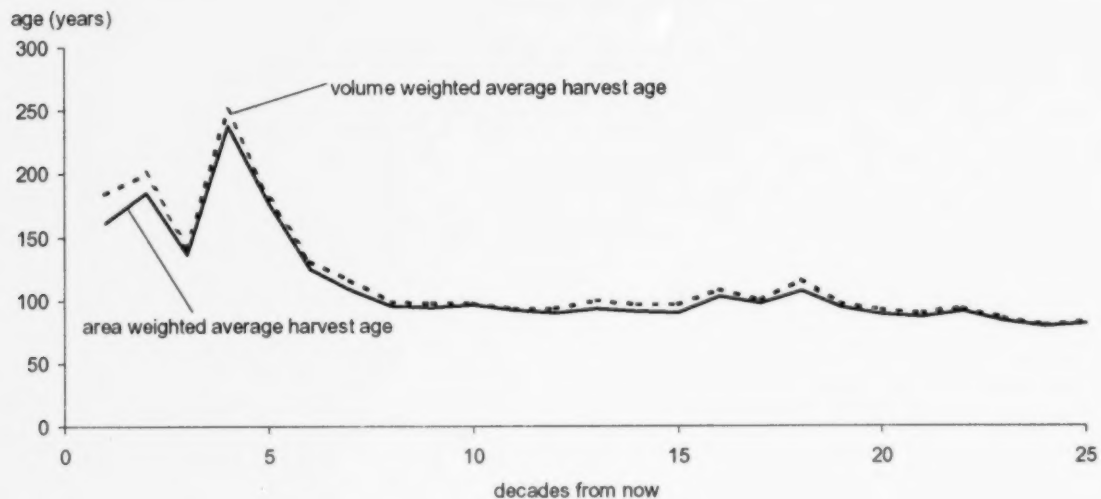


Figure 15. Average age of stands harvested over time — Golden TSA base case, 2003.

4 Results

4.3 Base case forest characteristics

Figure 16 shows growing stock levels for the timber harvesting land base. The total growing stock declines during the transition from harvesting in old existing stands to harvesting in younger managed stands. The merchantable growing stock for managed stands grows steadily from decades 4

to 20. Because some existing natural stands are excluded from harvest in the computer simulation to meet forest cover objectives, the merchantable growing stock level for natural stands declines to about 15% of the total rather than to zero. Figure 16 appears to show growing stock declining slightly at the end of the 250-year horizon, but 400-year forecasts indicate that growing stock is stable with minor fluctuations.

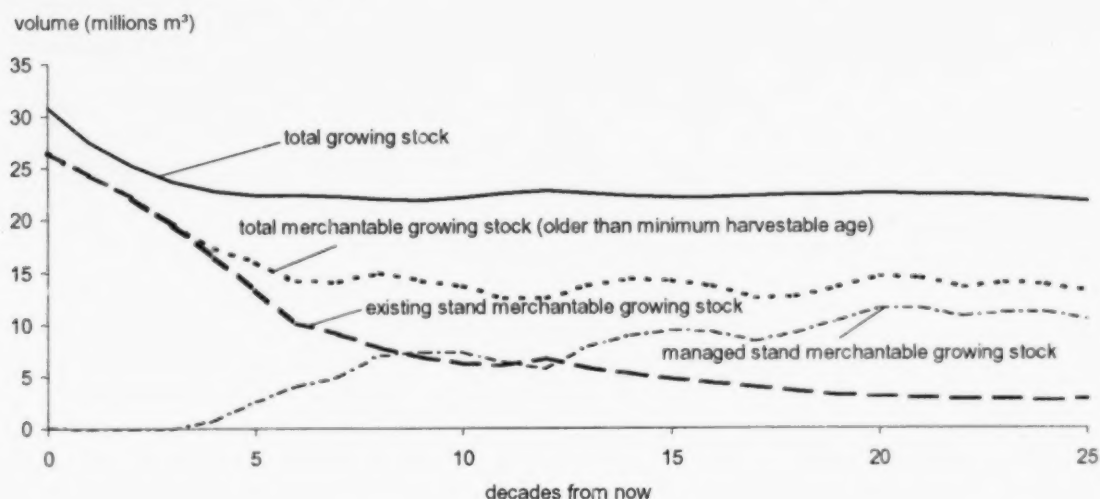


Figure 16. Timber growing stock forecasts for the timber harvesting land base — Golden TSA base case, 2003.

4 Results

The charts in Figure 17 show how the age composition of the Crown productive forest within the Golden analysis area would change over the next 250 years under the base case harvest forecast. The shaded and unshaded portions of each bar in the chart indicate the portion of productive forest within and excluded from the timber harvesting land base.

There are approximately 430 615 hectares of productive forest land base in the Golden analysis area, of which 153 870 hectares (35.7%) make up the initial timber harvesting land base (contributing forest). The current age class distribution has a significant gap of stands in the 41 to 60 year old age classes but the gap is not a limiting factor for timber supply at the beginning of the forecast. About 47% of stands within the timber harvest land base are currently at or above minimum harvestable age. Thirty per cent of stands on the timber harvesting land base are above 140 years of age and 12% are above 250 years of age.

In the productive forest outside the timber harvesting land base (non-contributing forest), 52% of the stands are above 140 years of age and 12% of the stands are older than 250 years of age. The non-contributing forest provides much of the old-forest area needed to meet habitat and landscape-level biodiversity requirements.

The trend over time is to a uniform age distribution within the timber harvesting land base. By year 100, the age class distribution for the stands on the timber harvesting land base is forecast to be relatively even in stands under 100 years of age. By year 250 this uniform age distribution remains but some of the timber harvesting land base has not been harvested due to forest cover constraints imposed to meet requirements for other resource values. In 250 years time, a little more than 5% of the stands on the timber harvesting land base are over 250 years of age, which is less than half of that in the current age class profile.

The charts in Figure 17 also reflect the assumption used in the timber supply model that natural disturbance occurs at an even rate (370 hectares per year) in the forest outside of the timber harvesting land base. This rate of disturbance was estimated based on the last seven years of fire history outside of the timber harvesting land base. In the analysis, this disturbance produces an even distribution of age classes outside the timber harvesting land base, although by year 250 there is still a large area that is 400 years and older. This distribution occurs because to reflect natural disturbance patterns, some forest outside of the timber harvesting land base was assumed to undergo disturbance on a 747-year rotation. As a result, some area remains undisturbed at the end of the 250-year forecast.

4 Results

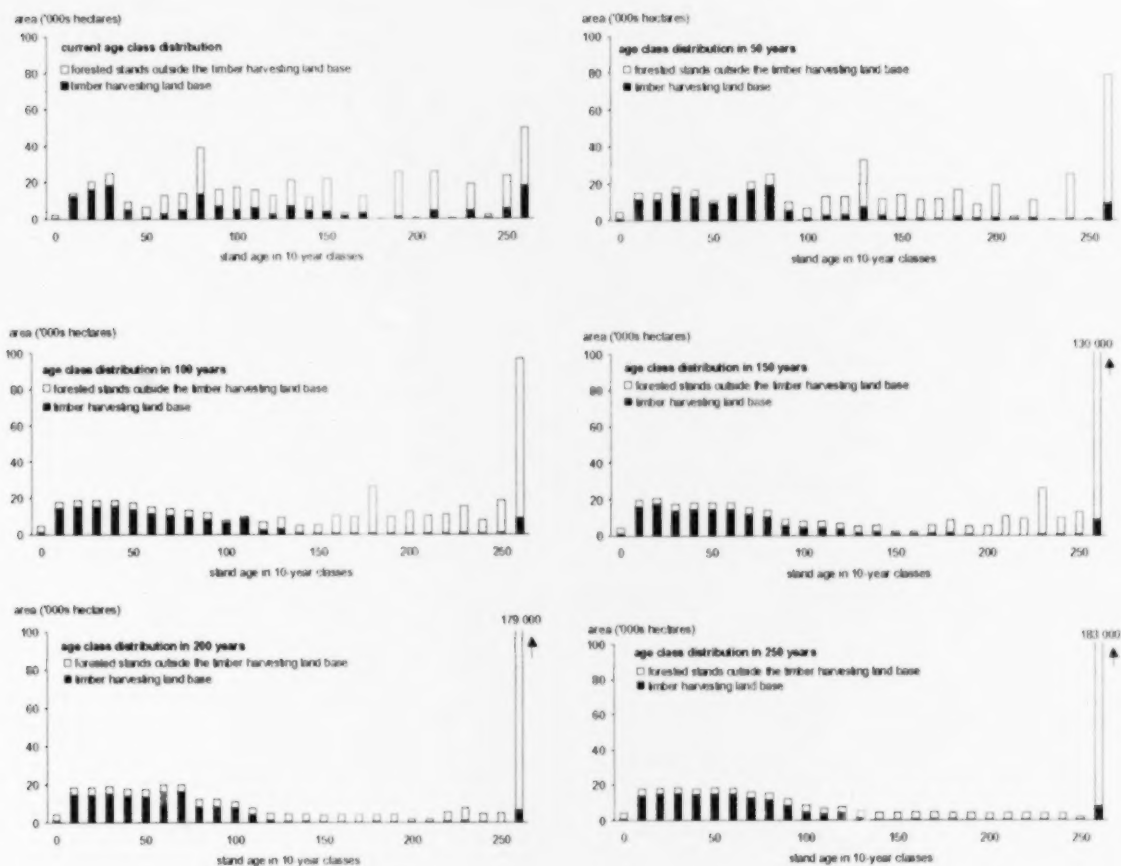


Figure 17. Changes in age composition on the Crown forest land base over time — Golden TSA base case, 2003.

5 Timber Supply Sensitivity Analyses

The best available information on forest inventories and management practices is used to analyse the timber supply implications of continuing with current management. However, forest management is complicated since it must account for diverse and changing human values, the dynamics of complex ecosystems, and fluctuating and uncertain economic factors. As well, forests grow quite slowly in terms of human life spans. It is therefore often useful to understand the long-term effects of changes or uncertainties in the information used for short-term decisions.

One important way to deal with this uncertainty is to revise plans and analyses frequently to ensure they incorporate up-to-date information and knowledge. Frequent planning and decision-making can help minimize any negative effects that may occur if decisions are based on inaccurate information. Frequent revision can also ensure that opportunities that become apparent from new information are not missed.

Another important way of dealing with uncertainty is to assess how values of interest, (for example, timber supply), could change if the information used in the analysis is not accurate. Sensitivity analysis* is one way of evaluating how

uncertainty could affect analysis results, and ultimately decision-making. Sensitivity analysis can highlight that fairly small uncertainties about some variables could have large effects on timber supply projections, or conversely that fairly large inaccuracies in others could have negligible effects. Also, sensitivity analysis could show that some variables affect timber supply more in the short term than in the long term, while others have the opposite effect. Sensitivity analysis can highlight priorities for collecting information for future analysis, and show which variables, and associated uncertainties, have the most significance for decisions. It can clarify whether current best estimates provide safe bases for decisions, or whether high uncertainty about important variables means more conservative decisions may be wiser.

In this section, results of a number of sensitivity analyses are discussed. Sensitivity analyses are intended primarily to test the relative change (i.e., high *versus* low sensitivity) in the harvest forecast resulting from changes in forest management assumptions and data used in the base case. Short-term refers to the first 20 years of the harvest forecast, medium-term is 21 to 100 years from now, and long-term is after 100 years from now.

Sensitivity analysis

A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case.

5 Timber Supply Sensitivity Analyses

5.1 Alternative harvest flows

The base case harvest forecast shown in Figure 10 was developed subject to several assumptions. For example, the initial harvest level was set at the current allowable annual cut. Figure 18 compares

two alternative forecasts with the base case. All inputs related to land base, growth and yield and management remain constant in all forecasts in Figure 18.

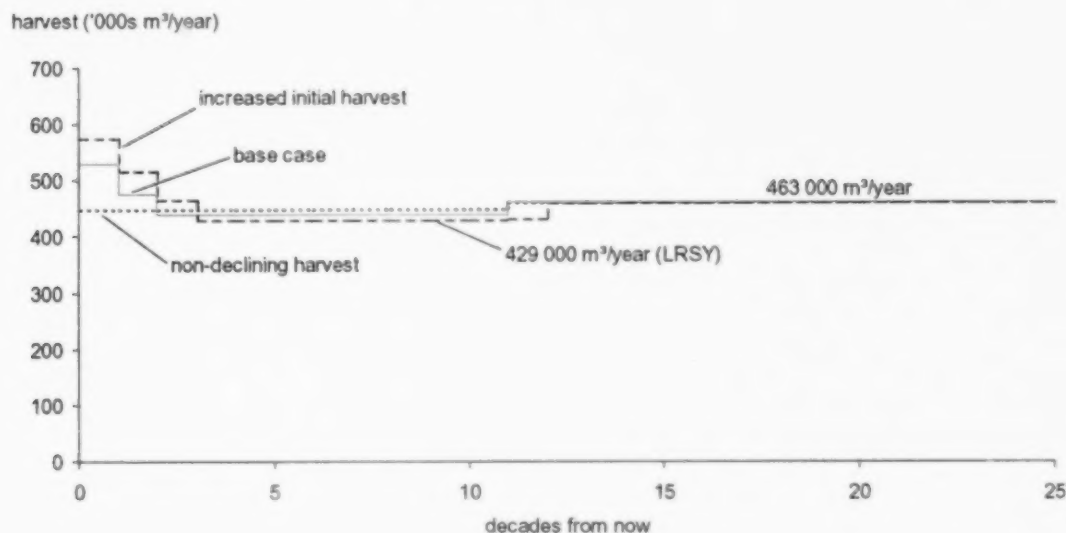


Figure 18. Alternative harvest forecasts — Golden TSA, 2003.

Increase initial harvest level

- It is possible to increase the initial harvest level for one decade by 8.5% to 575 000 cubic metres per year. The harvest level then declines to 2.5% below the base case mid-term level during decades 4 to 12.
- The mid-term harvest level of 429 000 cubic metres per year is the estimated long-term sustainable yield of the current timber harvesting land base, calculated using yield projections for unmanaged, naturally regenerated stands (not accounting for the effects of forest cover requirements).
- Over the 250-year horizon, the total harvest is slightly lower (0.06%) than that resulting from the base case.

Maximum non-declining flow

- A maximum non-declining harvest level of 449 000 cubic metres per year can be obtained for the first 11 decades of the harvest forecast. After decade 11 the harvest level can be increased to the long-term harvest level of 463 000 cubic metres per year.
- The short-term harvest level is 10.9% lower than that for the base case.
- The total harvest is slightly lower (0.3%) than in the base case over the 250-year horizon.

5 Timber Supply Sensitivity Analyses

5.2 Uncertainty in the land base available for timber harvesting

Uncertainty in the estimated size of the timber harvesting land base is due to factor such as fluctuations in timber prices, changes in harvesting and milling technology and land-use decisions. The timber harvesting land base has decreased by 7.6% since the last timber supply analysis for the Golden TSA, mainly due to more land being considered inoperable. Reductions for factors such as roads, riparian areas* and problem forest types have also changed significantly since the last analysis.

Currently there is no indication that the timber harvesting land base has been over or under estimated. However, sensitivity analyses were performed to provide general information that might help evaluate the implications of any new

information that becomes available before the AAC determination.

Uneconomic landscape units

Historically, harvesting has been heaviest in the southern portion of Golden TSA. This is because areas in the south are generally more accessible and more economic to harvest. As development progresses, however, the northern portion of the TSA will be relied upon more to contribute to the annual harvest. But not all areas in the north may be economic to harvest. Some may turn out to be too geographically isolated or too remote from centres of economic activity to be developed economically. Landscape units G-1, G-7, and G-12 are examples of such areas. Respectively, they account for 1973 (1.3%), 4586 (3.2%) and 557 hectares (0.4%) of the timber harvesting land base. Figure 19 shows the impact on the base case forecast of removing the potentially uneconomic landscape units from the timber harvesting land base.

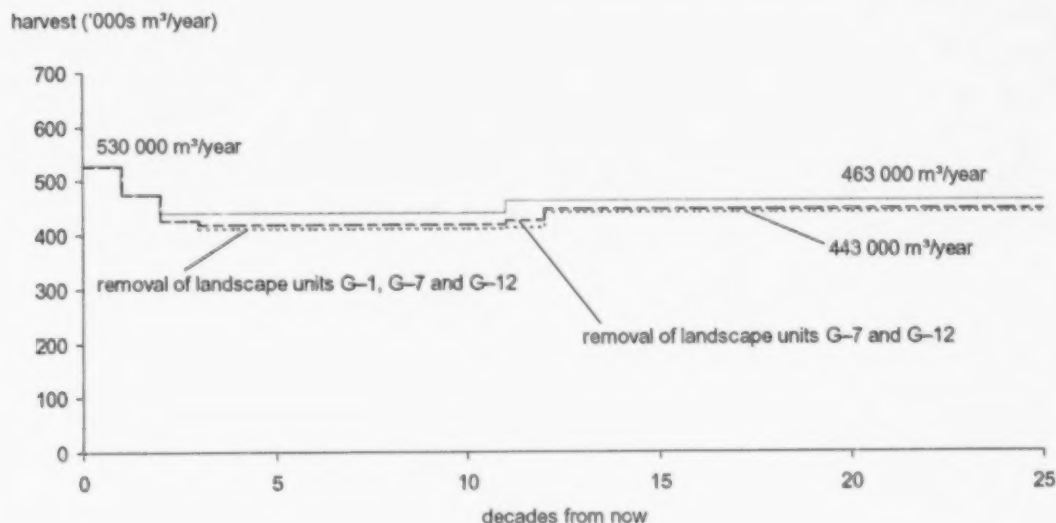


Figure 19. The effect on the harvest forecast of removing potentially uneconomic landscape units — Golden TSA, 2003.

Riparian area

Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.

5 Timber Supply Sensitivity Analyses

Removal of landscape units G-7 and G-12

- The timber harvesting land base is reduced by 3.6%;
- The short-term harvest level is the same as that in the base case;
- The mid-term harvest level decreases by 3.5%;
- The long-term harvest level decreases by 3.0%, and is reached one decade later.

Removal of landscape units G-1, G-7 and G-12

- The timber harvest land base is reduced by 4.9%;
- The short-term harvest level is unaffected, the mid-term level decreases by 5.6%, and the long-term level decreases by 4.9%.

Marginally merchantable hemlock stands

Stands dominated by old hemlock are often decadent and contain little merchantable timber. In the base case it was assumed that any stand older than 140 years of age comprised of 80% or more of hemlock is unmerchantable. In practice a multitude of factors influence the merchantability of a stand, and thus stands having a higher percentage of hemlock are occasionally included in the harvest and stands having a lower percentage of hemlock are sometimes excluded from the harvest.

In the base case, 985 hectares of hemlock stands were excluded from the timber harvesting land base due to their likely unmerchantability. Figure 20 shows the impact on the base case harvest forecast of expanding the land base exclusion by assuming any hemlock-leading stand (50% or more hemlock) older than 140 years of age is unmerchantable.

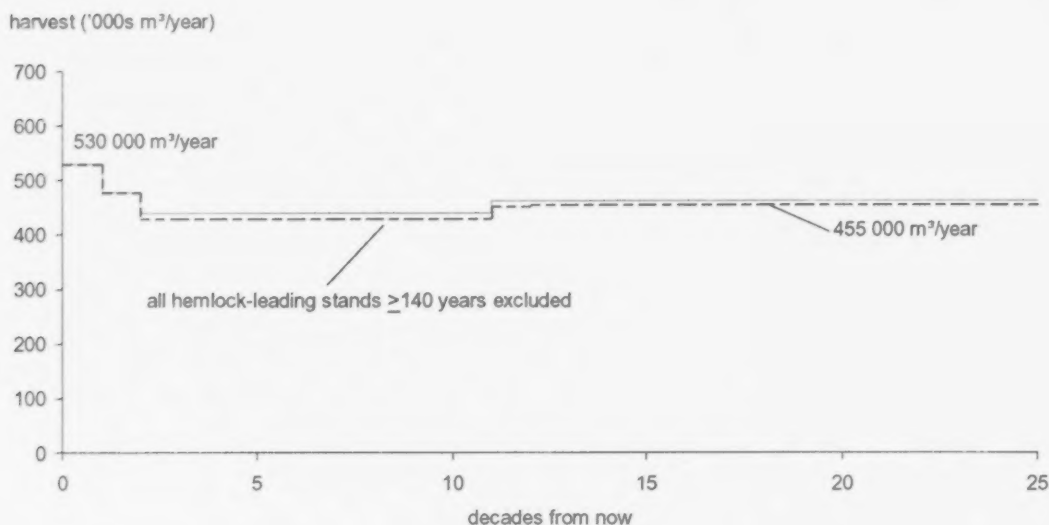


Figure 20. The effect on the harvest forecast of excluding additional areas of old hemlock — Golden TSA, 2003.

5 Timber Supply Sensitivity Analyses

All hemlock-leading stands older than 140 years of age excluded

- An additional 3921 hectares of old hemlock is removed, decreasing the size of the timber harvesting land base by 2.5%;
- The short-term harvest level remains the same, the mid-term level decreases by 2.5% and the long-term level decreases by 1.8%.

Mature operable timber

Stand-level biodiversity assumptions, operability, problem forest types, environmentally sensitive areas, low site, etc. all add an element of uncertainty about the size of the timber harvesting land base. To assess the impacts of these general uncertainties, area greater than the minimum harvestable age — approximately 46% of the current timber harvesting land base — was both increased and decreased by 10%. Figure 21 illustrates the impact on the base case forecast of increasing and decreasing the mature operable land base by 10%.

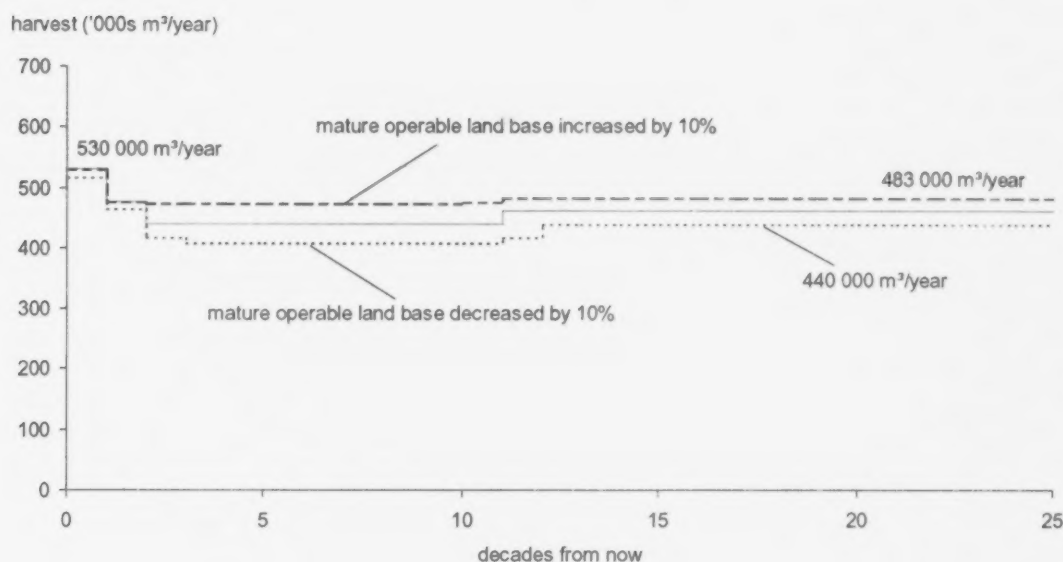


Figure 21. Harvest forecasts if the mature operable land base is increased or decreased by 10% — Golden TSA, 2003.

Mature operable land base decreased by 10%

- Removed 7444 hectares of mature timber from the timber harvesting land base, amounting to a 4.8% reduction in the size of the timber harvesting land base;
- The initial harvest level declines to 516 000 cubic metres per year from the base case level of 530 000 cubic metres per year, a reduction of 2.6%;

- The mid-term harvest level decreases by 7.8% and the long-term harvest level decreases by 5.4%.

Mature operable land base increased by 10%

- Added 7479 hectares of mature timber to the timber harvesting land base, increasing the size of the timber harvesting land base by 4.9%;
- The short-term harvest level remains the same, the mid-term level increases by 7.7% and the long-term level increases by 4.6%.

5 Timber Supply Sensitivity Analyses

5.3 Uncertainty in the estimated existing stand yields

Timber volume estimates for existing unmanaged stands are subject to uncertainties in the forest inventory used to estimate timber volumes (i.e., estimated tree heights and stand ages), and the statistical process used to develop the equations for predicting forest growth and yield. Timber volumes are normally accurate when averaged over large areas, but may not reflect actual volumes within individual stands. Uncertainty may also arise in the estimates of volume lost to decay in older trees, of waste and breakage during harvest, and of the utilization levels practiced during harvesting. In addition, productivity losses due to landings and trails for the Golden TSA were addressed in this analysis through the removal of volume from each stand. Uncertainty may arise around the magnitude and timing of these reductions.

Inventory audit

During the last several years, audits of the standing volume of trees within TSAs and TFLs* were performed across the province. These audits

provide an indication of how confident we can be in the estimated total volumes in the management unit. In 1994 an inventory audit was completed for Golden TSA. In April of 2002 a re-analysis of the audit data sets was done to provide a review of the accuracy of the volume, age and height attributes of the new Golden VRI photo-estimated inventory. The review showed that on average, height appears to be generally overestimated by approximately 5%, while age appears accurate. The implications of this finding to the volume estimates used in this timber supply analysis are not clear; however it does highlight the continuing uncertainty related to volume estimates. The combination of the new Golden vegetation resource inventory and changes to the VDYP yield model (BEC based loss factors *versus* 1976 loss factors), has increased the estimate of standing volumes by 5 to 10% relative to those in the previous inventory. The aggregated volume in this analysis was 6% greater than that in the 1998 analysis.

Given the uncertainties in existing stand volumes, the impacts of increasing and decreasing existing unmanaged stand yields (yield curves created through VDYP) by the standard $\pm 10\%$ were assessed. Figure 22 displays the results of this assessment.

Tree farm licence (TFL)

Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.

5 Timber Supply Sensitivity Analyses

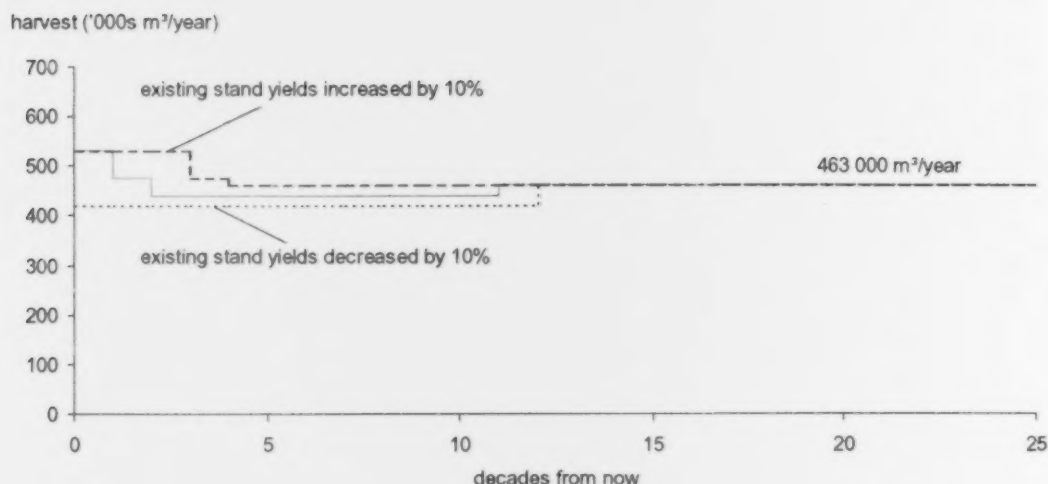


Figure 22. The effect on the harvest forecast of increasing and decreasing volume estimates for existing unmanaged stands — Golden TSA, 2003.

If existing unmanaged stand volumes are 10% lower than assumed in the base case

- The starting harvest level is 419 000 cubic metres per year, 20.9% lower than the current AAC, and is maintained for 13 decades;
- After decade 13, the harvest forecast is the same as the base case.

If existing unmanaged stand volumes are 10% higher than assumed in base case

- The current harvest level can be maintained for two decades longer than in the base case forecast;
- Between decades 5 and 11 the harvest forecast is 5.2% above the base case;
- After decade 12, the harvest forecast is the same as the base case.

In summary, uncertainties in existing stand volumes can affect harvest levels in both the short- and medium-terms.

5 Timber Supply Sensitivity Analyses

5.4 Uncertainty in the estimated managed stand yields

Uncertainty in volume estimates for managed stands exists for the same reasons listed for existing stand yields (inaccuracies in the forest inventory and the growth and yield models), but also because

of the limited experience and data that is available for regenerated managed stands in B.C. In this section, the timber supply effects of uncertainty associated with predicting volumes in regenerated stands is examined. Figure 23 shows the harvest forecasts that result when managed stand volumes are increased and decreased by 10%.

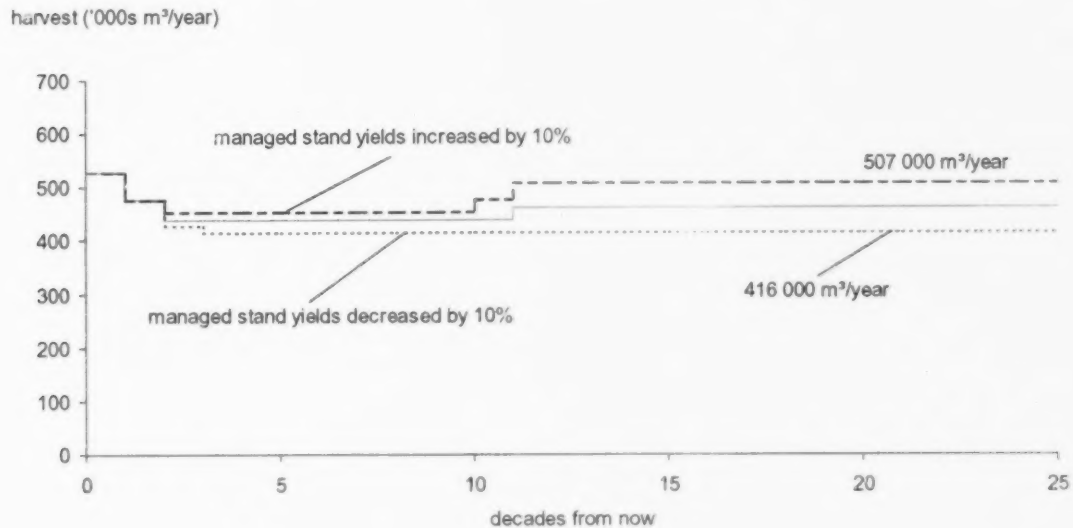


Figure 23. The effect on the harvest forecast of increasing and decreasing volume estimates for managed stands by 10% — Golden TSA, 2003.

5 Timber Supply Sensitivity Analyses

Managed stand yields decreased by 10%

- The harvest forecast is the same as the base case over the short term;
- A new long-term harvest level is reached in decade four, and is 10.2% below the base case long-term level.

Managed stand yields increased by 10%

- The harvest forecast is the same as the base case over the short term;
- Between decades 3 and 10 the harvest forecast is maintained at 455 000 cubic metres per year, 3.4% greater than the base case level;
- Long-term harvest level is increased 9.5% over that of the base case long-term level.

In summary changes to managed stand yields have no effect on the short-term harvest forecast for Golden TSA. Regenerated stands are not eligible for harvest until they have reached their minimum harvestable ages, which range between 60 and 140 years. The harvest is not projected to be dominated by regenerated stands until about 110 years from now (see Figure 11).

5.5 Uncertainty in caribou management

The northern part of Golden TSA overlaps the range of one of only three viable populations of mountain caribou in western Canada. Because of the importance of this blue-listed species there has been ongoing work within the scientific community refining caribou management guidelines and caribou habitat maps. Along with this work has been considerable debate over what management guidelines to use and where.

The base case used the higher-level plan (HLP) map in modelling forest cover requirements for seasonal caribou habitats. This map and the cover requirements modelled are consistent with *Objective 3 of the Kootenay-Boundary Higher Level Plan Order (KBHLPO)*. The HLP map last updated in April 1997 identifies 20 731 hectares of the timber harvesting land base (13.5%) as caribou habitat. Since April 1997 revisions have been made to the HLP caribou map and the modified map was incorporated into the information file created for this analysis. The 'modified' caribou map identifies 23 790 hectares of the timber harvesting land base (15.5%) as caribou habitat. The forest cover requirements applicable to caribou habitat are described in Section 2.3, "Management practices."

5 Timber Supply Sensitivity Analyses

Figure 24 shows the potential impact on timber supply of retaining old forest within areas identified on the modified caribou map as opposed to the HLP

map. Figure 24 also shows the potential impact of retaining significantly more old forest within areas identified on the HLP map.

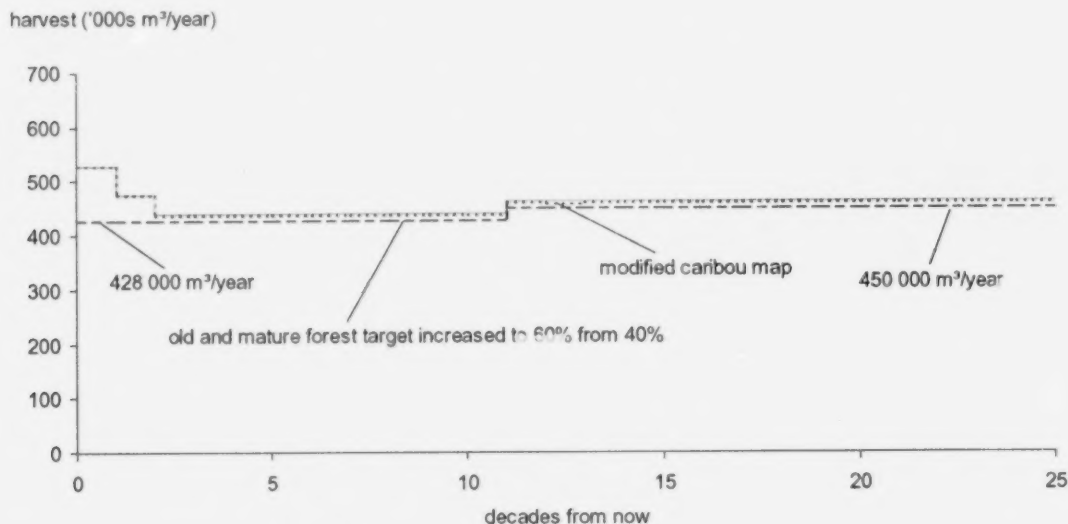


Figure 24. Harvest forecasts reflecting modifications to caribou habitat map and to forest cover requirements for caribou habitat — Golden TSA, 2003.

Higher-level plan map replaced by modified caribou map

- 3059 hectares, about 2%, more of timber harvesting land base identified as suitable habitat;
- The short-term harvest level remains unaffected, the mid-term harvest level decreases slightly;
- The long-term harvest level is decreased by 0.6% over that of the base case long-term level.

Old and mature forest retention target increased by 20 percentage points

- Apply 60% old and mature forest target on caribou habitat areas below the 1994 operability line rather than 40% old and mature forest target as in the base case harvest forecast;
- Initial harvest level declines by 19% to 428 000 cubic metres per year;
- Between decades 3 and 10 the harvest forecast is maintained at 428 000 cubic metres per year, 2.7% lower than the base case level;
- The long-term harvest level is decreased by 2.8% over that of the base case long-term level.

5 Timber Supply Sensitivity Analyses

5.6 Uncertainty about management requirements in visually sensitive areas

About 13% of the Golden TSA timber harvesting land base is subject to visual quality objectives. Most of this area (11% of the timber harvesting land base) is classified as retention or partial retention visual quality class (VQC) and is covered by *Objective 9* of the *Kootenay-Boundary Higher Level Plan Order*. *Objective 9* makes known these areas as 'scenic areas' and requires that their quality of views from communities, major waterways and major highways be conserved.

The acceptable level of harvest from visually sensitive areas is a function of the visual absorption capacity, the visual quality rating, and the current visual condition of each area. Uncertainty about

forest cover and green-up objectives for visual quality may arise from inventory and classification of land into visual absorption capacity classes, from estimates of how well different disturbance limits may meet visual objectives, and from estimates of how non-harvestable forest contributes to visual quality.

Percentage of allowable visual disturbance

In the base case, the allowable visible disturbance (percentage of forest area allowed to be below green-up height) was set at the maximum of the applicable range (25% for modification, 15% for partial retention, 5% for retention and 1% for preservation). Figure 25 shows the results of increasing the allowable visible disturbance to that of the next less restrictive VQC (i.e., use 25% for partial retention VQC rather than 15%, since modification is the next less restrictive class to partial retention).

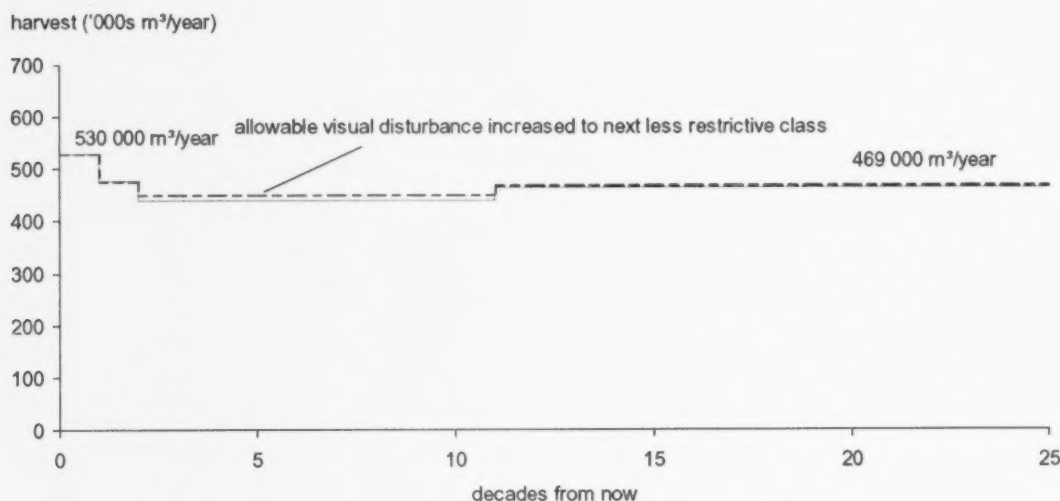


Figure 25. The effect on the harvest forecast of decreasing forest cover constraints for visually sensitive areas — Golden TSA, 2003.

Allowable visual disturbance set one class lower

- The short-term harvest level remains the same as in the base case;
- The mid-term harvest level is increased by 2.5%;
- The long-term harvest level is increased by 1.4%.

5 Timber Supply Sensitivity Analyses

5.7 Uncertainty in application of seral stage retention recommendations

The *Forest Practices Code (FPC) of British Columbia Act* describes the conservation of biodiversity as an essential component of sustainable forest use. The *Landscape Unit Planning Guide (LUPG)* provides recommendations for maintaining biodiversity at both the stand- and landscape-levels. Further to the *FPC* and *LUPG*, *Objective 2* of the *Kootenay-Boundary Higher Level Plan Order* identifies biodiversity emphasis option (BEO) and corresponding old and mature forest targets for landscapes making up the Golden Resource Management Zone — which is the same area as the Golden analysis area.

Stand-level biodiversity

Stand-level biodiversity is addressed in the Golden TSA through the retention of wildlife tree patches (WTP). Based on information in the *Landscape Unit Planning Guide* the wildlife tree patch retention percentage within cutblocks is 6.2% on average for the Golden TSA. The retention percentage is based on the assumption that 50% of the wildlife tree requirements will be met from the

non-contributing forest areas. Many of the wildlife tree patches are greater than two hectares in size and can contribute to old-growth targets at the landscape level. To reflect retention of wildlife tree patches, a percentage was removed from the area of each stand in the timber harvesting land base. In total 8982 hectares were removed from the timber harvesting land base to account for wildlife tree patches. Uncertainty about the wildlife tree retention reduction is addressed generally in Section 5.2, "Uncertainty in the land base available for timber harvesting."

Landscape-level biodiversity

Management for landscape-level biodiversity as indicated by *Objective 2* in the *Kootenay-Boundary Higher Level Plan Order* was modelled in this analysis. Forest cover requirements were applied to each combination of natural disturbance type (NDT), biogeoclimatic subzone, and variant within each landscape unit. In the base case, old-plus-mature forest targets were applied to landscape units and BEC variants as indicated in the *KBHLPO*. In areas subject to low BEO, an initial reduction of the old-forest requirements to one-third of the target was allowed in the base case. The full requirement was applied in the third rotation (see Appendix A, Section A.4.11, "Forest cover requirements" for further details).

5 Timber Supply Sensitivity Analyses

Three sensitivity analyses were performed to evaluate the potential timber supply impacts associated with uncertainty about landscape-level

biodiversity management. Figure 26 shows the sensitivity of the harvest forecast to changes in forest cover requirements for landscape-level biodiversity.

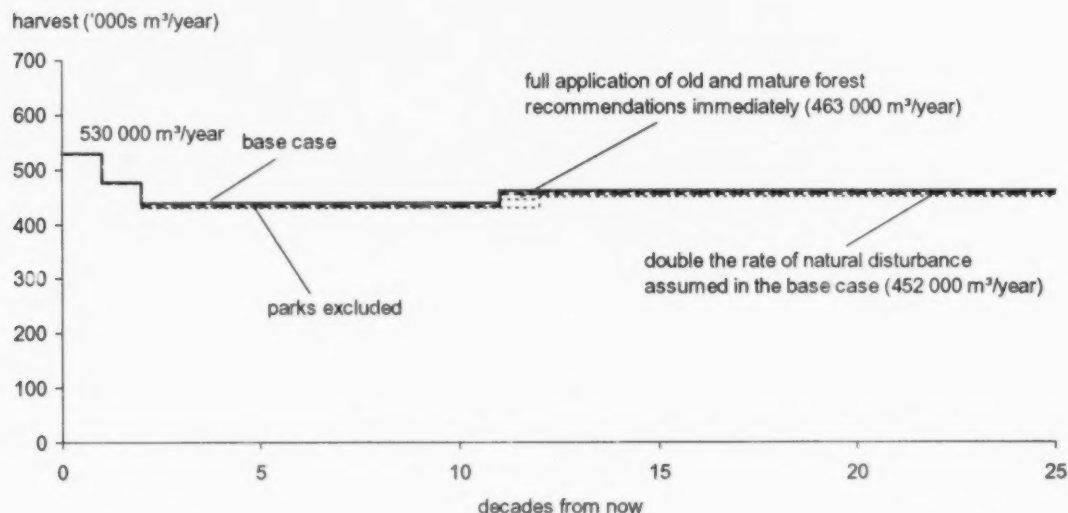


Figure 26. Sensitivity analysis of requirements for landscape-level biodiversity — Golden TSA, 2003.

1. Apply full old-seral targets for lower BEO immediately, instead of phasing it in over three rotations, and apply mature seral* *Landscape Unit Planning Guide (LUPG)* recommendations in all landscape units, instead of applying mature seral targets as per the higher level plan (October 2002). This has no impact in the short term. The mid-term harvest level decreases by 2% and the long-term harvest level decreases by 0.4%.
2. Apply landscape level biodiversity targets to the TSA portion of a landscape unit only, excluding any contribution from neighboring parks. The mid-term harvest level decreases slightly and the long-term harvest level decreases by 1.3%.
3. Double the rate assumed in the base case for natural disturbance in forest outside of the timber harvesting land base (i.e., 740 hectares per year versus 370 hectares per year). This has no impact in the short term, the mid-term harvest level decreases by 2% and the long-term harvest levels decreases by 2.4%.

Mature seral

Forest stands with trees between 80 and 120 years old, depending on species, site conditions and biogeoclimatic zone.

5 Timber Supply Sensitivity Analyses

5.8 Impact of all forest cover requirements combined

Forest cover requirements are applied to maintain wildlife, visual quality and water values; to represent cutblock adjacency; and to maintain old forest to conserve landscape-level biodiversity. Sensitivity analyses examining individual types of

forest cover requirements are presented in Sections 5.5 through 5.7. Figure 27 shows how timber supply would be affected if all of the forest cover requirements (except stand-level biodiversity requirements) were removed simultaneously. This demonstrates the combined effect of all forest cover requirements on the timber supply.

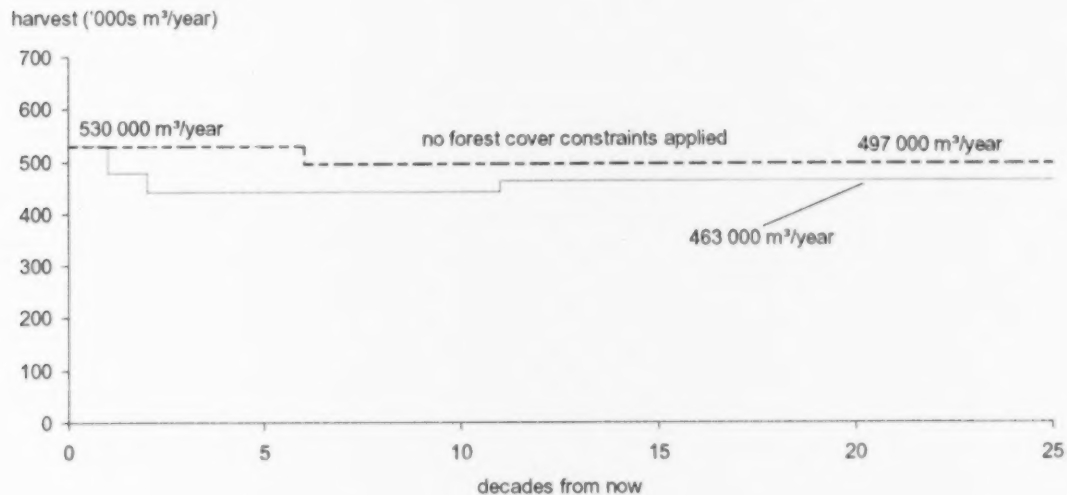


Figure 27. Timber supply forecast if no forest cover constraints are applied — Golden TSA, 2003.

- The current harvest level can be maintained for six decades as compared to one in the base case harvest forecast;
- The long-term harvest level increases by 7.3%.

5 Timber Supply Sensitivity Analyses

5.9 Uncertainty in site productivity

The productivity of a site largely determines how quickly trees will grow. It therefore affects the timber volumes in regenerated stands, the time to reach green-up and the age at which those stands will reach merchantable size. The most accurate estimates of site productivity come from stands between 30 and 150 years old. At ages less than about 30 years, (particularly stands less than 15 years) the growth history of trees has not yet been long enough to give accurate measurements of site productivity using conventional site index tools (site curves) and inventory estimates of height and age.

Site productivity estimates derived for older stands may also be incorrect as stands are well past the age of maximum height growth and have often been affected by disease, insects and top damage as they reach an advanced age. As a result, measurements from these trees can lead to underestimation of the growing potential of the site. If the site productivity estimates from these older stands are used to estimate the growth potential of young replacement stands, volume growth could also be underestimated.

Old-growth site index (OGSI)

For spruce, balsam and pine stands not covered by localized site index adjustment equations, recent province-wide research projects provide estimates

of the productivity of sites currently occupied by old-growth stands. Two Old-Growth Site Index (OGSI) studies applicable to timber supply forecasting are as follows:

- *Site index adjustments for old-growth stands based on paired plots* (Nussbaum 1998). Data were obtained from paired plots installed in old-growth stands, and adjacent logged and regenerated stands of the same productivity. Site index was estimated for both stands and comparisons were made. Results are available for Douglas-fir, lodgepole pine, and interior spruce stands.
- *Site index adjustments for old-growth stands based on veteran trees* (Nigh 1998). The objective of the study was to develop site index adjustments for species not covered by the paired-plot project. The data for this study was obtained from temporary and permanent plots with a veteran and main stand component. The site indices for the two components were estimated and an adjustment equation for each species was derived using linear regression analysis. The results of the studies are considered less reliable than those from the paired-plot study.

The results of these two studies are of interest in the Golden TSA since stands older than 140 years comprise 29.5% of the timber harvesting land base.

5 Timber Supply Sensitivity Analyses

Site productivity sensitivities

To test the sensitivity of the base case harvest forecast to the uncertainty in site productivity estimates, two analyses were performed.

- The first sensitivity analysis incorporated OGSi adjustments of site indices for stands older than 140 years of age. Either the paired-plot or veteran-tree result was applied, where suitable. Managed stand volume estimates for those analysis units (AU)* affected by changes in

estimated future productivity were recalculated based on average adjusted site productivity. Green-up and minimum harvestable ages were also recalculated.

- The second analysis was similar to the first except that only the paired-plot (pine and spruce) results were applied, where applicable.

Figure 28 shows how timber supply is affected if OGSi site index values are used for stands over 140 years of age.

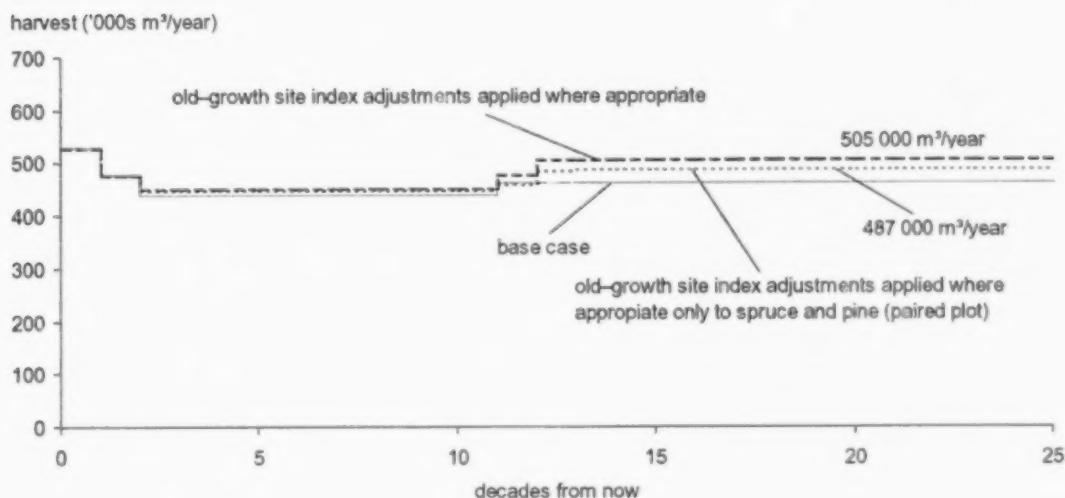


Figure 28. Harvest forecasts based on OGSi site index adjustments — Golden TSA, 2003.

Analysis unit

A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables.

5 Timber Supply Sensitivity Analyses

Harvest forecast with OGSi adjustments (veteran- and paired-plot studies)

- The harvest forecast is the same as base case over the short term;
- In the medium term the harvest forecast increases by 2.9%;
- The long-term harvest level increases by 9.0%

Harvest forecast with paired-plot OGSi adjustments only

- In the mid term the harvest forecast increases by 2.3%;
- The long-term harvest level increases by 5.2%.

The paired-plot and veteran adjustments did not have a larger effect on the harvest forecast because they apply to only about one-third of the timber harvesting land base. In addition, about half of the area subject to adjustment is spruce, and about 70% of the timber harvesting land base is in the ICH zone, for which the spruce paired-plot adjustment is small.

5.10 Uncertainty in minimum harvestable ages

Minimum harvestable ages are an estimate of the time needed for stands to reach a merchantable condition. They affect the time over which the harvest of existing stands must be rationed while regenerating stands grow to a merchantable age.

The time at which stands will become merchantable is not known with precision because of uncertainty about the growth of regenerated stands, and an inability to foresee future conditions that will determine merchantability.

For this analysis, minimum harvestable ages were defined as the age at which a stand reaches a minimum merchantable volume, a minimum diameter and 95% of the culmination mean annual increment (MAI). Minimum volumes ranged from 150 cubic metres per hectare for species other than cedar or hemlock to 200 cubic metres per hectare for cedar and hemlock. Minimum diameters were 20 centimeters for pine and deciduous species, and 25 centimeters for other species. See Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis" for the minimum harvestable ages applied in the base case. Minimum harvestable ages are generally below the age at which average stand growth is maximized (culmination of MAI). For existing stands, the average minimum harvestable age for all stands across the TSA is 103 years, while culmination of MAI occurs on average at 117 years of age. In regenerated, managed stands, the average minimum harvestable age for the entire TSA is 91 years *versus* 105 years for culmination of MAI. Generally, the minimum harvestable ages used in the base case harvest forecast prevents a stand from being harvested at an age when its volume growth is significantly less than the maximum. Figure 29 shows the impact on the harvest forecast of increasing and decreasing minimum harvestable ages by 10 years.

5 Timber Supply Sensitivity Analyses

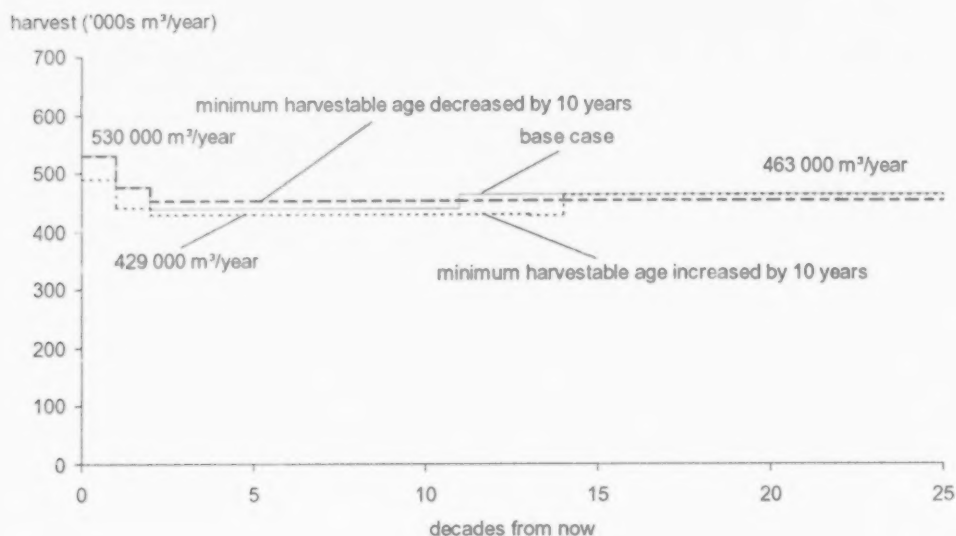


Figure 29. Harvest forecasts if minimum harvestable ages are increased or decreased by 10 years — Golden TSA, 2003.

Minimum harvestable ages decreased by 10 years

- The base case harvest level is met for the first two decades;
- Timber supply in the medium-term increases by 3.2%, and does not fall below the long-term harvest level;
- The long-term harvest level is decreased by 1.9%.

Minimum harvestable ages increased by 10 years

- The initial harvest level declines to 490 000 cubic metres per year from the base case level of 530 000 cubic metres per year, a reduction of 7.5%;
- Timber supply in the medium term is 2.5% lower than in the base case;
- The rise to the long-term harvest level is delayed by 3 decades as compared to the base case.

5 Timber Supply Sensitivity Analyses

5.11 Uncertainty in harvest order of stands

In the base case, the priority of a stand for harvest was based on development plans, silvicultural system and species within a geographic area. Stands proposed for harvest within forest development plans were given the highest harvest priority in the analysis. Stands within the partial cutting zone were given the second highest. Spruce and cedar stands in the northern portion of the TSA and fir and pine stands in the southern portion were given the third highest priority as a group. Finally if the harvest target still could not be met, the remaining stands above minimum harvestable age were prioritized for harvest as a group. Harvest of stands within the groups was relative oldest first (i.e., harvest of stands the greatest number of years

above minimum harvest age). This "group priority" harvest rule was created to reflect the harvesting patterns expressed in past and proposed forest development plans, and is considered a better reflection of operations in the TSA than using more standard harvest rules.

To understand the impact of using alternate harvest rules for harvest of stands within the groups, three more scenarios were tested: the absolute oldest first harvest rule (harvest of oldest stands), the random harvest rule (random harvest of any stand above minimum harvestable age) and the youngest first harvest rule (harvest of stands the least number of years above minimum harvestable age). Figure 30 shows how timber supply is affected by changing stand harvest priorities (harvest priority between groups remains the same in each scenario).

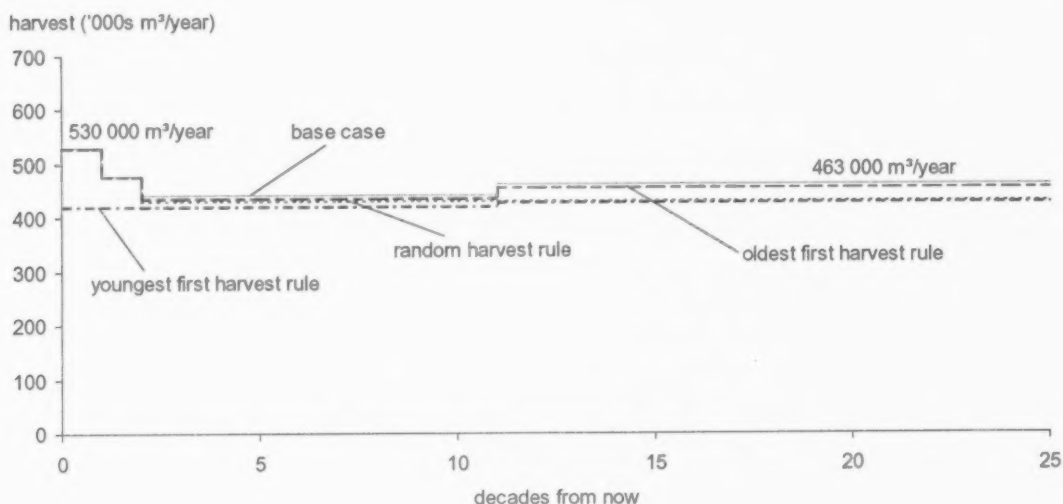


Figure 30. Alternative harvest queue (priority) rules — Golden TSA, 2003.

5 Timber Supply Sensitivity Analyses

Random harvest rule

- Choose stands that are older than the minimum harvestable age at random for harvesting;
- The harvest level is the same as the base case over the short term;
- The long-term harvest is 7.1% lower than in the base case.

Oldest first harvest rule

- Sets the highest priority on oldest stands;
- The harvest levels is the same as the base case over the short term;
- Harvest levels are slightly lower in both the medium and long term (0.9 and 1.3% respectively).

Youngest first harvest rule

- Sets the highest priority on youngest stands older than the minimum harvestable age;
- The harvest level immediately declines by 20% relative to the base case;
- Over a 250-year period 6.8% less volume is harvested.

5.12 Combined uncertainties

The previous sections presented sensitivity analyses testing the uncertainty associated with individual issues. This section presents a sensitivity analysis evaluating the impacts of a combination of uncertainties. This helps to ascertain the total uncertainty associated with the assumptions in the base case forecast. Figure 31 shows the result of a

sensitivity analysis that combined the following changes to three factors considered in the base case:

- Volume estimates for existing stands were reduced by 5%. The amount of the reduction reflects a possible overestimation of existing stand volumes suggested by the re-analysis of 1994 inventory audit data against the new VRI.
- Any cutting permit or category A cutblock above the 2002 operability line was excluded rather than included in the timber harvesting land base, reducing the size of the timber harvesting land base by 3197 hectares.
- The operational adjustment factor (OAF) accounting for productivity losses associated with unclassified trails and landings was reduced from 3.0% to 1.5%.

Performance of this sensitivity analysis is not meant to imply that the changes better reflect reality. Rather, the changes were made to assess the impacts of changes since the last analysis, and of remaining uncertainty about the ultimate operability of proposed blocks about the operability line.

Alternative 1 — mid-term harvest level reduced to avoid reduction in short-term harvest levels

- Harvest allowed to drop in the mid term to the long-term sustainable level based on unmanaged stand yields rather than the base case mid-term level, after reduction in the size of the timber harvesting land base taken into account.
- The short-term harvest level remains the same as the base case, the mid-term level decreases by 4.3% and the long-term harvest level decreases by 1.1%.

5 Timber Supply Sensitivity Analyses

Alternative 2 — mid-term harvest level equivalent to base case mid-term level

- Medium-term harvest level adjusted downwards by 2% to reflect the reduction in the size of the timber harvesting land base (3197 hectares).
- The initial harvest level declines to 431 000 cubic metres per year from the base

case level of 530 000 cubic metres per year, a reduction of 19%.

- The mid-term harvest level decreases by 2% and the long-term harvest level decreases by less than 1%.

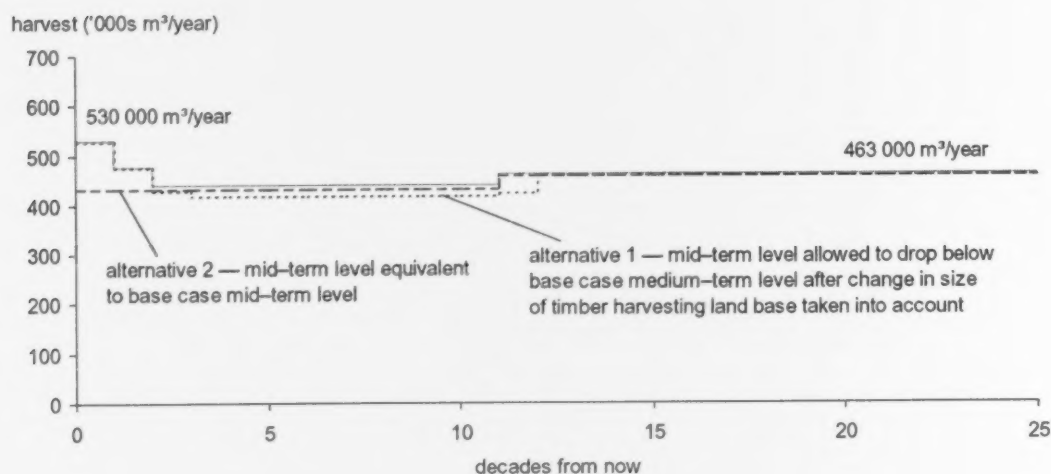


Figure 31. Sensitivity analysis of combined uncertainties — Golden TSA, 2003.

5 Timber Supply Sensitivity Analyses

5.13 Additional uncertainties with small impacts on timber supply

Changing green-up periods by ± 5 years had a negligible effect on harvests projected in the medium term and no effect on harvests projected in the short- and long-term. Partial cutting alleviates green-up constraints in about 35% of areas harvested during the first twenty years of the forecast, thereby reducing the potential impact of cutblock adjacency and green-up constraints. Also, removing adjacency and green-up constraints completely had negligible impact on projected harvests.

Objective 5 of the *Kootenay-Boundary Higher Level Plan Order* requires the maintenance of old and mature forests within mapped connectivity corridors (map 5.1 of *Kootenay-Boundary Higher Level Plan Order*), for the purposes of regional forest ecosystem connectivity. A procedure contained in *Objective 5* is used to determine the amount of old and mature forest available for connectivity corridors. Using this procedure, limits were placed on harvesting in connectivity corridors over the first twenty years of the harvest forecast.

Harvesting was restricted where the amount of old and mature forest was below the recommended amount for the corridor area after taking into account 20 years of aging. These limits had no impact on the harvest levels projected in the base case.

Making scenic areas first priority for harvest in the group priority rule had no impact on harvests projected in the short- and medium-terms. The long-term harvest level was reduced by less than 1%.

5.14 Summary of sensitivity analysis impacts

Table 6 summarizes the results of all the sensitivity analyses, indicating the harvest level per cent relative to the base case for each test conducted. The percentages in Table 6 are based on a comparison of cumulative harvests over the three time periods: short term (1-20 years); medium term (21-100 years); and long term (101-250 years). Hence, the values in some cases do not match those reported in the specific sensitivity analysis sections, which mostly focus on differences observed in a particular period (e.g., the first decade, rather than the first 20 years; or the most stable medium-term harvest level rather than the cumulative harvest between years 21 and 100).

5 Timber Supply Sensitivity Analyses

Table 6. Summary of sensitivity analyses — Golden TSA, 2003.

Report section	Harvest forecast description	Harvest level per cent relative to the base case		
		Short term (1-20 years)	Medium term (21-100 years)	Long term (> 100 years)
5.1	Alternative harvest flow — increase initial harvest level	109	99	99
	Alternative harvest flow — maximum non-declining flow	89	102	100
5.2	Land base change — remove landscape units 7 & 12	100	96	97
	Land base change — remove landscape units 1,7, & 12	100	94	95
	Land base change — remove more old hemlock (50% v 80% H)	100	98	98
	Land base change — operable mature decreased by 10%	97	93	95
	Land base change — operable mature increased by 10%	100	108	105
5.3	Existing stand volumes decreased by 10%	83	96	99
	Existing stand volumes increased by 10%	105	108	100
5.4	Managed stand volumes decreased by 10%	100	95	90
	Managed stand volumes increased by 10%	100	103	110
5.5	Caribou management — use modified v HLP caribou map	100	100	99
	Caribou management — 60% v 40% age class 8 & 9 requirement	85	97	97
5.6	VQOs — allowable visual disturbance set one class lower	100	103	101
5.7	Seral stage requirements — old targets in lower BEO immediately	100	98	99
	Seral stage requirements — no contribution from neighboring parks	100	99	99
	Seral stage requirements — x 2 rate of natural disturbance	100	98	97
5.8	Impact of all forest cover requirements combined	100	117	108
5.9	Uncertainty in site productivity — OGSi applied where appropriate	100	103	108
	Uncertainty in site productivity — paired plot adjustments	100	102	105
5.10	Uncertainty in minimum harvestable ages — decreased by 10 years	100	103	99
	Uncertainty in minimum harvestable ages — increased by 10 years	93	98	98
5.11	Uncertainty in harvest order of stands — random harvest rule	100	98	93
	Uncertainty in harvest order of stands — oldest first harvest rule	100	99	99
	Uncertainty in harvest order of stands — youngest first harvest rule	84	96	93
5.12	Combined uncertainties — alternative 1	100	96	99
	Combined uncertainties — alternative 2	86	98	99
5.13	Additional tests, small impact — increase green-up by 5 years	100	100	100
	Additional tests, small impact — decrease green-up by 5 years	100	100	100
	Additional tests, small impact — no adjacency constraints	100	100	100
	Additional tests, small impact — connectivity corridors	100	100	100
	Additional tests, small impact — scenic areas priority for harvest	100	100	100

6 Summary and Conclusions of the Timber Supply Analysis

The results of this timber supply analysis suggest that, given data and management assumptions that reflect current information and practices, the current allowable annual cut for the Golden TSA of 530 000 cubic metres per year can be maintained for 10 years. The projected harvest level of 530 000 cubic metres per year declines by 10% after 10 years and declines again by 7.8% after 20 years, where it stabilizes at 440 000 cubic metres per year for a period of 90 years. After 110 years from the present, the harvest forecast rises to the long-term harvest level of 463 000 cubic metres per year, a level 12.6% lower than the current AAC. The period of reduction and increase is referred to as the "transition" period.

A series of sensitivity analyses showed that data and management uncertainties affect timber supply projections to varying degrees, some with positive impacts and others with negative impacts.

Short-term timber supply is sensitive to changes that influence the amount of timber available from existing unmanaged stands, because the harvest forecast relies on harvests from these stands for the next 110 years. Lower estimates of timber volumes in existing stands, reduction in the size of the timber harvesting land base, particularly the portion of it occupied by mature timber, increases in minimum harvestable ages, and more stringent caribou management guidelines, all had large effects on the base case short-term harvest levels (next 20 years). An analysis of re-stratified inventory audit data suggested that net merchantable volumes are overestimated from 4 to 10% depending on the population of interest and the utilization level. Overestimates for stands 140 years of age and older are statistically significant, and are mainly due to tree heights being overestimated by 3.2 metres on average. Sensitivity analysis showed that if existing stand volumes were 10% lower than the inventory estimates the initial harvest level is reduced by approximately 21% to 419 000 cubic metres per year.

The medium-term timber supply (21 to 100 years from now) is affected by many of the factors tested through sensitivity analysis. Factors that alter either the total amount of existing volume, or the ability to access existing and managed volume during the first 100 years will affect medium-term timber supply. In addition, alternative choices of harvest flow during the transition to the long-term level affects medium- and short-term harvest levels. For example, a choice to delay the decline from the initial harvest level by one decade reduces the

medium-term harvest level projected in the base case. Conversely, choosing to make less volume available in the short term by lowering the initial harvest level increases the medium-term harvest level. The medium term is affected by changes in the following: the size of the timber harvesting land base; volumes from existing stands; volumes from managed stands; wildlife habitat guidelines, allowable visual disturbance, stand and landscape-level biodiversity; site productivity estimates; rules governing which stands are selected for harvesting; and minimum harvestable ages.

Uncertainty about the economics of harvesting in landscape units 1, 7 and 12 could change medium- and long-term timber supply. If these forests were excluded, the timber harvesting land base would be reduced by 4.9% and harvest levels projected over the medium term would decrease by 5.6%. The long-term harvest level would decrease by 4.9%.

Uncertainty in managed stand volumes caused changes to medium- and long-term timber supply. If managed stand volumes were 10% higher than estimated in the base case, the medium-term timber supply would increase and long-term timber supply would be 9.5% higher. If managed stand volumes were 10% lower than estimated, the mid-term harvest level would be reduced and long-term timber supply would be 10.2% lower than the base case.

About 13% of the timber harvesting land base is subject to visual quality objectives. The assumption in the base case was that the allowable disturbance in the each visual quality class would be at the maximum of the applicable range. If the maximum of the next less restrictive visual class was assumed, the medium-term timber supply would increase and long-term timber supply would be 1.4% above the base case.

The *Kootenay-Boundary Higher Level Plan Order* has removed some of the uncertainty around maintaining biodiversity by identifying biodiversity emphasis options and corresponding old and mature forest targets for landscapes making up Golden TSA. The uncertainty in application of seral stage targets generally has a downward influence on harvest levels projected in the medium- and long-terms. If natural disturbances in forests outside the timber harvesting land base are twice the rate assumed in the base case, the long-term harvest level decreases by 2.4% from that of the base case. If old and mature forest targets applied to the TSA portion of a landscape only, excluding any contribution from neighboring parks, the long-term harvest level would be 1.3% below the base case.

6 Summary and Conclusions of the Timber Supply Analysis

Changes in site productivity estimates caused changes to medium- and long-term timber supply by affecting volume estimates of regenerating stands and the size of the timber harvesting land base. When old-growth site index adjustments (both veteran and paired-plot) were used for regenerated stands, the medium-term timber supply increased, and long-term timber supply increased by 9%. When only adjustments based on paired-plot studies were used, affecting only spruce and pine, the long-term timber supply increased by 5.2%.

Long-term timber supply (over 100 years from now) is affected by uncertainties in all of the above

factors with the exception of changes to existing stand volumes.

In conclusion, this analysis indicates that based on current inventory, growth and yield, and forest management information, timber harvests in the Golden TSA can be maintained at the current level for 10 years. The analysis indicates that several factors related to the current forest inventory and management regime could affect timber supply. No conclusive evidence was available prior to completion of this analysis to suggest that significant inaccuracies exist in the information used.

7 Socio-Economic Analysis

The potential impact of timber supply adjustments on local communities and the provincial economy is an important consideration in the timber supply review. This section examines the socio-economic implications of the base case harvest flow in the Golden TSA. Base case harvest levels are those that can be sustained over time given the current forest management regime.¹ The analysis compares the level of forestry activity currently supported by the TSA timber harvest to the level of activity that could be supported as the Golden timber supply approaches its long-term harvest level.

The socio-economic analysis includes:

- a profile of the current socio-economic setting;
- a description of the forest industry; and
- an analysis of the socio-economic implications of the base case harvest forecast.

7.1 Socio-economic setting

7.1.1 Current population and demographic trends

The Golden TSA is sparsely populated, with most of the population in the Town of Golden.

Unincorporated communities include Nicholson, south of Golden, and a rural population corridor from the southern boundary of the Rocky Mountain Trench to Donald in the north. In 2001, the Golden TSA had an estimated population of almost 6,500 (see Table 7), an increase of about 10% since 1996 primarily due to a ski resort development near Golden.

Forecasts for the Columbia-Shuswap Regional District, which includes the Golden TSA, indicate a population increase of about 1.5%² by 2006. To a large degree, this growth will depend on the stability of the forest industry and new investments in tourism and real estate.

Table 7. Population statistics, Golden TSA

Communities	Population 1996 census	Population 2001 census	% change 1996 – 2001
Golden	3,968	4,020	1.3
Other communities ^a	1,964	N/A	
Total — Golden TSA	5,856	6,455	10.2

Source: BC STATS, with 1996 and 2001 Census data. Using 2001 Census geography.

(a) Estimated by BCSTATS to be about 60% of Columbia-Shuswap Census Subdivision A.

(1) The timber supply review and the socio-economic analysis does not consider the implications of changes in the resource management regime and land use.

(2) BC STATS, Population Section. Based on Golden Local Health Area.

7 Socio-Economic Analysis

7.1.2 Economic profile

Current Economic Structure

Economic dependency estimates developed by BC STATS provide the best indication of the "basic" sectors that make up the structure of, and drive local economies.³ As Table 8 illustrates, the key sources of basic employment in the Golden TSA are tourism, forestry, and the public sector (including education, health, and other federal, provincial and local public services).

Tourism-related employment, including accommodation, and parts of food, retail trade and other sectors, accounts for about 28% of total

employment in the Golden TSA. Forestry accounts for about 26%, and the public sector about 23%. Other sectors of current and historical importance to the local economy include rail and highway transportation, by virtue of Golden's location on national east-west transportation routes, and two mines producing industrial minerals.

Since employment does not take into account differences in seasonality and average wages between industries, employment income can be a better indicator of a sector's contribution to the economy. As shown in Table 8, tourism accounted for 28% of basic employment but 12% of basic income in 1996, reflecting its lower wages and part-time employment.

Table 8. Comparison of employment and income dependencies, (from 1996 census data), Golden TSA^a

Basic sector ^a	% of basic employment	% of basic income ^b
Tourism	28	12
Forestry and related	26	27
Public sector	23	21
Transportation, other ^c	11	11
Construction	7	6
Mining and related	3	3
Agriculture and food	2	1
Non-employment income	N/A	20
Total	100	100

Source: BC STATS, *The 1996 Forest District Tables*, April, 1999.

(a) Figures may not add due to rounding. Includes direct, indirect and induced contribution of the sector to TSA economy.

(b) After tax income, including non-employment sources of income such as pensions, investments and transfer payments.

(c) "Other" includes parts of manufacturing and other miscellaneous industries.

Basic sector

Sectors of the economy, such as forestry, tourism and mining, that create flows of income into the region and are assumed to be drivers of the local economy. Non-basic sectors, such as retail outlets, are supported by basic sectors.

(3) Basic sector employment is derived from, but is defined differently than labour force data. For example, basic employment excludes unemployed and includes both direct and indirect employment generated by basic sector companies purchasing inputs and other goods and services. The public sector is treated as a basic sector because the level of activity is largely determined by factors external to the local economy. See *British Columbia Local Area Economic Dependencies and Impact Ratios - 1996*, BC STATS, May, 1999.

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Trends in Economic Structure

Labour force data more recent than for 1996 is not available for the Golden TSA. However, given the growth in population from 1996 to 2001, it can be assumed that the labour force also grew. The provincial, experienced labour force increased by about 5.5% over the same period. There was also likely a continuation of a similar historical trend towards service sector industries in the TSA and elsewhere in B.C.

The growth of tourism has reinforced this shift to the service sector in the Golden TSA. The recent completion of the Golden Peaks Resorts Inc., four-season, five-star resort, has been the driving force in the area's tourism economy. Primary factors contributing to the declining, relative importance of the goods-producing sector have been international market factors such as the softwood lumber dispute.

7.2 Golden TSA forest industry

7.2.1 Current allowable annual cut and apportionment

The current allowable annual cut (AAC) for the Golden TSA, established in January 2000, is 530 000 cubic metres, a significant decline from the AAC of 650 000 cubic metres in place from 1981 to 1995.⁴ The current AAC is apportioned to various types of licences, as summarized in Table 9. Two forest licensees, Louisiana Pacific and Wood River

Inc., account for more than 80% of the apportionment and the Ministry of Forests' BC Timber Sales (BCTS – formerly Small Business Forest Enterprise Program) accounts for another 15%.

7.2.2 Golden TSA harvest history

Table 9 also summarizes the volume of timber harvested in the Golden TSA from 1998 to 2002. It indicates that recent actual annual harvests by licensees and by BCTS were about 130 000 cubic metres lower than the AAC over the 1998-2002 period, most likely due to a disparity between the costs of accessing the timber and the relatively low market values over recent years.

While the AAC sets the maximum permissible harvest level, the actual volume of timber harvested in a particular year determines the level of economic activity. If actual annual harvest levels are consistently lower than the AAC, then forestry activity is below its full potential.

Some changes to the apportionment and harvesting rights have occurred yet are not reflected in the official apportionment statistics. Due to undercuts, a take back of volume occurred in 2002 and the forest licences have an apportionment of 393 781 cubic metres. Louisiana Pacific (LP) also took a temporary reduction in AAC of 133 00 cubic metres for 2000 and 2001. The 266 00 cubic metre total volume was advertised as a non-replaceable forest licence but there were no bidders.

Table 9. *Volume billed, by type of licence, 1998 – 2002 (cubic metres), Golden TSA*

Type of licence	Current AAC ^a	1998	1999	2000	2001	2002	1998 – 2002 average
Forest licence	426 542	293 072	279 327	323 591	289 597	276 719	292 461
BC Timber Sales (BCTS)	81 912	39 539	74 002	49 468	109 356	45 663	63 606
Forest Service reserve / other ^b	21 546	55 616	42 395	54 825	33 140	32 993	43 794
Total harvest ^c		388 227	395 724	427 884	432 093	355 375	399 860
Total allowable annual cut	530 000	540 000	540 000	530 000	530 000	530 000	530 000

Source: Ministry of Forests, harvest database. Numbers may not add due to rounding.

(a) The Golden TSA AAC was reduced to 530 000 cubic metres effective January 1, 2000.

(b) "Other" consists of cutting authorities such as rights-of-way, road permits and other small temporary permits.

(c) Timber harvested from private lands is not included.

(4) The Golden TSA timber supply review does not include woodlots (the AAC for which is established separately from the TSA by the District Manager), or non-recoverable losses (e.g., due to fire).

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7.2.3 Golden TSA major licensees and processing facilities

LP Engineered Wood Products Ltd. (acquired from Evans Forest Products in late 1999) currently has a replaceable forest licence to harvest 342 466 cubic metres per year. An estimated 80% to 85% of LP's harvest is processed within the Golden TSA, with the remaining volume sold or traded to other processors outside the TSA. More than 90% of the workers employed by LP live within the Golden TSA.

LP, under Evans Forest Products, restructured and resumed operation of its plywood mill operation in Golden, and in 1998 it established a new laminated veneer lumber (LVL) operation at its Golden plant that uses peeled veneer from the plywood mill. The plywood mill can process an estimated 300 000 cubic metres of timber annually.

After LP, the next largest primary processing plant in the Golden TSA is Canadian Timber Frames, which began operations on the former Golden Specialty Woods Products and Veneer Ltd. site. Canadian Timber produces cants for home building and its estimated annual timber requirement is 3000 cubic metres. A number of small-scale lumber mills in the Golden TSA process about 3000 cubic metres of timber annually, and rely on sales through BCTS for their timber supplies.

Wood River Forest Inc. (Wood River) currently has a replaceable forest licence to harvest 51 315 cubic metres per year. The timber is processed in the company's lumber plant in Revelstoke, outside the Golden TSA. All Wood River employees live outside the Golden TSA.

The current volume apportioned to the BCTS in the Golden TSA is approximately 81 800 cubic metres per year. An estimated 70% is processed within the Golden TSA, and an estimated 65% of workers associated with the BCTS harvesting and silviculture activities live within the Golden TSA.⁵

7.2.4 Total Golden TSA timber supply and processing capacity

Approximately 60%-70% of the total timber harvested in the Golden TSA is processed within the TSA. Most of the remaining volume is processed in the Revelstoke TSA. The annual timber requirement of the processing plants located in the Golden TSA is estimated at 320 000 cubic metres, all of which could be supported directly or indirectly by current AAC apportionments if fully harvested.⁶

7.2.5 Forestry sector employment and employment coefficients

Employment coefficients developed for the previous Timber Supply Review analysis, expressed as full-time jobs or person-years of employment per 1000 cubic metres of harvest, are summarized in Table 10. TSA coefficients include residents of the Golden TSA who are supported by timber harvesting in the TSA. Provincial coefficients include all residents of the province that rely on the Golden TSA timber supply.

Employment is divided into direct, indirect and induced components, the sum of which is the total impact. Indirect and induced employment estimates are based on multipliers developed by BC STATS. See Appendix B for more information regarding employment coefficients and multipliers.

(5) These estimates are based on data compiled from *Golden Timber Supply Review Analysis Report*, Ministry of Forests, August, 1998.

(6) As noted above, part of these timber requirements, such as fir peelers for the LP plywood mill, are supported indirectly by the TSA harvest by trading some of these logs non-TSA timber.

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Table 10. Direct, indirect and induced employment and employment coefficients, Golden TSA^a

	TSA employment (person-years)	TSA employment coefficients (person-years/000s cubic metres)	Provincial employment (person-years)	Provincial employment coefficients (person-years/000s cubic metres)
Harvesting	194	0.48	231	0.57
Silviculture	4	0.01	49	0.12
Processing	267	0.66	316	0.78
Total direct	465	1.15	596	1.47
Indirect + induced ^b	190	0.47	471	1.16
Total employment	655	1.62	1,067	2.63

(a) Employment estimates are reported in person-years. Harvesting coefficients are based on results of industry survey undertaken for the *Golden TSR Analysis Report* (1998). Processing coefficients are based on Ministry of Forests mill survey data and average harvest levels for the 1999-2001 period. Coefficients may not add due to rounding. Total employment was estimated by applying coefficients to the current harvest level, which averages about 405 000 cubic metres for the most recent years available (2000-02). The proportion of non-resident employment and employment supported by non-Golden TSA harvests is based on survey results from the 1998 *Golden TSR Analysis Report*.

(b) Indirect and induced impacts for the TSA are based on the mid-point of a range of multipliers for timber harvesting and processing estimated by BC STATS (1999). Provincial multipliers are based on Ministry of Finance and Corporate Relations (1999). The upper limit assumes that all displaced workers will leave the Golden TSA or the province. The lower limit assumes that employment insurance and social assistance payments to displaced workers will encourage them to remain in the TSA or the province.

As indicated in Table 10, harvesting, silviculture and processing activities associated with the average TSA 2000-02 harvest of about 405 000 cubic metres supported an estimated 465 person-years of direct employment in the TSA and 596 person-years of direct employment provincially. Total employment in the TSA, including multiplier effects, is estimated at 655 person-years, for a total employment coefficient of 1.62 person-years per 1000 cubic metres. Total provincial employment, including multiplier effects, is estimated at 1,067 person-years, or about 2.63 person-years per 1000 cubic metres.⁷

7.2.6 Golden TSA forestry employment income

Currently, the average annual income for direct forestry employees is about \$50,100 and indirect

and induced average annual incomes, \$32,100.⁸ Based on average harvests over the 2000-02 period, and multipliers developed by BC STATS, the Golden TSA's timber harvest generates approximately \$29.9 million in direct employment income and an additional \$15.1 million of indirect and induced income, for a total of \$45 million in employment income, or about \$111,000 per 1000 cubic metres harvested.

Provincial government revenues from the forest industry come from three major sources:

- stumpage, royalties and rent payments;
- forest industry taxes, including logging, corporate income, sales, property, and electricity taxes; and
- income taxes paid by those who are employed in the industry.

(7) Employees in the Ministry of Forests are not included as part of direct employment in the forestry sector because their activities are primarily related to government policy rather than to the volume of timber harvested.

(8) Statistics Canada, Labour Force Survey, B.C. Industrial Comparison - Average Weekly Wage Rates. BC Stats www.bestats.gov.bc.ca

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As shown in Table 11, between 1998 and 2002, the timber harvest in the Golden TSA contributed an estimated \$3.1 million in stumpage and related payments annually to the provincial government. Other taxes paid by the forest industry, such as logging tax, corporate income, property and sales taxes, contributed approximately \$3.4 million

annually. In addition, the provincial government received approximately one-third of the \$2.8 million in income taxes paid by forestry sector employees.⁹ It should be noted that these are estimates of gross revenues, and do not take into account management, administration and other public costs attributable to the forest industry in B.C.

Table 11. Estimate of provincial revenues, Golden TSA

	Average volume harvested (2000-02)	Estimated provincial revenues (\$ per '000s cubic metres) (\$ million)	Provincial revenue (\$ million)
Stumpage and related revenues ^a	405 000	\$3.1	\$7,644
Forest industry taxes ^b	405 000	\$3.4	\$8,302
Employment income taxes ^c	405 000	\$2.8	\$7,000
Total		\$9.3	\$22,946

(a) Ministry of Forests, Revenue Branch. Includes stumpage, royalties and rents.

(b) PricewaterhouseCoopers estimates of taxes paid directly by the forest industry for logging, corporate capital, sales, property, electricity, and provincial share of corporate income, for the years 1995-99, the most recent available.

(c) Canada Customs and Revenue Agency. Locality Code Statistics Tables. 2002 Edition (2000 Tax Year). www.ccr-aadrc.gc.ca/tax/individuals/stats/gb00/pst/locsts/lsdown_by_prov-e.html

7.3. Socio-economic implications of the base case harvest forecast

The base case harvest flow projection indicates that the current AAC of 530 000 cubic metres can be maintained for 10 years. In year 11, a timber supply reduction of 10% to 477 000 cubic metres is projected. At year 21, there is a further reduction of about 8% to 440 000 cubic metres, which is maintained for another 10 decades, at which time the timber supply increases to its long-term level of 463 000 cubic metres.

7.3.1 Employment, income and government revenue implications of base case harvest levels

Based on the results of the timber supply analysis, current forestry-related activity can be maintained

for the first decade. Although the timber supply is projected to decrease after that, it will not go below the recent average or peak harvest level. Economic impacts over the entire base case harvest projection period would take the form of reduced growth potential rather than loss of existing activity, and could see forestry activity and employment increase.¹⁰

Employment, income and government revenues supported by future, potential harvest levels can be estimated using the coefficients estimated in Tables 10 and 11 above. These coefficients are subject to a number of long-term variables that are difficult to predict, such as technological change, wood product markets and prices, and government policies. Increases in harvest levels would only occur if market and other factors changed sufficiently to warrant harvesting of currently unutilized timber.

(9) The strength of the linkage between these levies and changes in timber harvest levels can vary by revenue source. For example, corporate capital and property tax revenues will not likely change unless there is a permanent mill closure or reduction in the value of the facility. Also, these are gross estimates that do not include changes in Ministry of Forests' or overall government costs due to harvest level changes. Finally, these estimates assume that there are no alternative uses of capital or labour in the economy that will generate provincial revenue.

(10) It is assumed that AAC changes would be prorated among licensees. Adjustments in allotments and harvest areas may be required for licensees who have been harvesting near their full allotment to ensure that they would not be disproportionately affected by AAC reductions.

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Golden TSA future growth potential in employment and income

Based on the timber supply analysis, the decline in the Golden TSA AAC represents a reduction in forestry growth potential of about 90 000 cubic metres by year 21, but still allows for growth of 40 000 cubic metres above recent average harvest levels in the TSA.

Using the employment coefficients in Table 10, and assuming that a similar proportion of the harvest was processed in the TSA as currently, the decline in

timber supply shown in the base case represents a reduction in forestry-related employment potential of about 86 (859-773) direct, indirect and induced jobs* within the TSA by year 11, compared to the current AAC. Also, even at its lowest level (after 20 years), the base case timber supply projection would still allow for an increase of 60 direct, indirect and induced jobs within the TSA, compared to the current harvest level. All of these estimates assume that market conditions and other factors warrant harvesting of currently unutilized timber.

Indirect and induced jobs

Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets.

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Table 12. Golden TSA socio-economic impacts of base case harvest forecast

	Economic impact of current harvest level	Potential economic impact of projected timber supply ^a	
		Decade 1 (current AAC)	Decade 2
Current AAC / future timber supply	530 000	<u>530 000</u>	<u>477 000</u>
Current harvest level (2000-02 average)	<u>405 000</u>	405 000	405 000
Difference from current AAC	0	0	(53 000)
Golden TSA			
Employment		(person-years)	
Direct	465	610	549
Indirect + Induced	190	249	224
Total	655	859	773
Range of employment gain (loss) from current harvest level	0	204	118
Employment income		(\$2002 million per year)	
Direct	23.3	30.6	27.5
Indirect + Induced	6.1	8.0	7.2
Total	29.4	38.6	34.7
Province^b			
Employment		(person-years)	
Direct	596	779	701
Indirect + Induced	471	615	553
Total	1,067	1,394	1,254
Range of employment gain (loss) from current harvest level	0	327	187
Employment Income		(\$2002 million per year)	
Direct	29.9	39.0	35.1
Indirect + Induced	15.1	19.7	17.8
Total	45.0	58.7	52.9
Provincial government revenues		(\$2002 million per year)	
Stumpage & related payments	3.1	4.1	3.4
Forest industry taxes	3.4	4.4	3.7
Employee income taxes	2.8	3.7	3.3
Total	9.3	12.2	10.4

(a) Assumes market, technology and other factors permit use of currently unutilized timber.

(b) TSA employment and income estimates are included in the provincial employment and income estimates. All estimates based on data in Sections 7.2.5 and 7.2.6.

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Provincial future growth potential

Provincial employment includes all forestry sector employment supported by the timber harvested from the Golden TSA, including employment within the TSA. Using the employment coefficients in Table 10, the decline in timber supply represents a reduction in potential forestry-related employment at the provincial level of about 140 (1,394-1,254) direct, indirect and induced jobs, compared to the current AAC, assuming utilization of currently uneconomic timber. Timber supply available after year 11 would also still allow for an increase of 190 jobs over recent historical levels.

In the short term, the base case timber supply forecast for the Golden TSA would not result in any reduction in provincial revenues. By year 11, growth potential in provincial revenues could be reduced by about \$1.8 million per year, but would still allow for possible future increases of about \$1.0 million per year, assuming that currently unutilized timber could generate the same average revenue per cubic metre as indicated in Table 11.

7.3.2 Implications for processing facilities in the Golden TSA

The projected base case timber supply should be sufficient for existing mills in the TSA, but the nature of the timber profile would still require some trading for timber suitable for veneer production. Total current processing capacity in the TSA is estimated at about 320 000 cubic metres per year.

The forecast timber supply reductions could constrain the development of a new medium to large processing facility in the Golden TSA, which would require roughly 200 000 to over 500 000 cubic metres of timber per year. The current over-capacity of processing facilities in the Kootenay portion of the Southern Interior Forest Region makes such expansion unlikely even if current harvest levels could be maintained for several decades. The forecast timber supply reduction would not preclude additional smaller mills serving niche markets, value-added production, or existing processors modestly expanding their primary processing capacity.

7.3.3 Community impacts

The Golden TSA relies on the forest industry for a substantial portion of its economic activity. The recent population growth shows that the loss of 180 full-time jobs when the Evans lumber mill closed in 1996 has largely worked its way through the TSA economy. The base case timber supply projection indicates that the forestry sector can maintain its current contribution to the TSA's economy.

The stability and possible increases in existing timber supply levels will allow time for other sectors, such as tourism, to increase their importance and provide additional stability and diversification to the economy in the Golden TSA.

7.3.4 Regional timber supply issues

Roughly 30% of the Golden TSA's harvest has been processed outside the TSA. Since reduced timber supply levels projected for the Golden TSA still exceed recent historical levels, timber supplies for mills outside the TSA will not be affected.¹¹

LP routinely exchanges timber from its licence in the Golden TSA for high-quality logs required for veneer and veneer products. Recent estimates indicate that the LP plant received almost 50% of its log supply from outside the Kootenay area of the Southern Interior Forest Region, and from private sources. This means that processing facilities and communities within the Golden TSA can be affected by timber supply changes in other TSAs. Information from timber supply reviews for other TSAs in the east Kootenay region indicates that timber supplies in the region will likely decline within 10 to 15 years.¹²

(11) Assuming adjustments in licence volumes to mitigate potential impacts of future AAC reductions for non-locally based licensees such as Wood River, who have been harvesting almost all of their current apportionment.

(12) Based on TSR2 analyses for the Cranbrook, Invermere, and Revelstoke TSAs, including the implications of the *Kootenay-Boundary Land Use Plan*.

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7.4 Summary

The forest industry is the largest private sector source of basic income in the Golden TSA economy. LP Engineered Wood Products Ltd. operates the largest processing facilities in the TSA, and Wood River is the other major licence holder with a lumber mill in Revelstoke.

Within the Golden TSA, the current harvest level supports an estimated 655 person-years of employment annually (includes direct, indirect and induced jobs) and \$29.4 million in employment income. Provincially, it supports 1,067 full-time jobs, \$45.0 million in employment income and \$9.3 million in gross provincial revenues. In recent years, harvests in the Golden TSA have been below the AAC. If the current AAC of 530 000 cubic metres was fully utilized, there could be increases in employment, employment income and provincial government revenues.

The base case harvest forecast for the Golden TSA indicates a stable timber supply for the

first 10 years, with a reduction in year 11 and a further deduction in year 21 for a total reduction of approximately 90 000 cubic metres, or 17% lower than the current AAC. However, compared to current harvest levels it should still allow for some increases in forestry-related activity within the Golden TSA and province.

The potential economic impacts of reduced harvest levels would only occur if market and other factors changed sufficiently to warrant harvesting of currently unutilized timber, and if this timber generated the same employment, income and revenue impacts per cubic metre.

The base case timber supply forecast indicates that forestry will remain a key sector in the Golden TSA economy and could even grow somewhat, despite future timber supply declines. The stability in timber supplies for the first decade should also provide sufficient time for other sectors to grow, providing greater economic diversification and stability.

8 References

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9 Glossary

Allowable annual cut (AAC)	The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood per year.
Analysis unit	A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables.
Base case harvest forecast	The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.
Basic sector	Sectors of the economy, such as forestry, tourism and mining, that create flows of income into the region and are assumed to be drivers of the local economy. Non-basic sectors, such as retail outlets, are supported by basic sectors.
Biodiversity (biological diversity)	The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.
Biogeoclimatic (BEC) variant	A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.
Biogeoclimatic zones	A large geographic area with broadly homogeneous climate and similar dominant tree species.
Coniferous	Coniferous trees have needles or scale-like leaves and are usually 'evergreen'.
Cutblock	A specific area, with defined boundaries, authorized for harvest.
Cutblock adjacency	The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions.
Deciduous	Deciduous trees shed their leaves annually and commonly have broad-leaves.

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Employment coefficient	The number of person-years of employment supported by every 1000 cubic metres of timber harvested; for example, a coefficient of 1.0 indicates that every 1000 cubic metres harvested supports one person-year, or 500 000 cubic metres supports 500 person-years.
Employment multiplier	An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job.
Environmentally sensitive areas	Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches.
Forest cover objectives	Specify desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives. General adjacency and green-up guidelines are also specified using forest cover objectives (see Cutblock adjacency and Green-up).
Forest inventory	An assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of other forest values such as recreation and visual quality.
Forest Practices Code	Legislation, standards and guidebooks that govern forest practices and planning, with a focus on ensuring management for all forest values.
Forest type	The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples.
Free-growing	An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.
Green-up	The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas.
Growing stock	The volume estimate for all standing timber at a particular time.

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Harvest forecast

The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized over time for a specified land base and set of management practices. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.

Higher level plans

Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area.

Indirect and induced jobs

Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets.

Inoperable areas

Areas defined as unavailable for harvest for terrain-related or economic reasons. Operability can change over time as a function of changing harvesting technology and economics.

Integrated resource management (IRM)

The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making.

Landscape-level biodiversity

The *Landscape Unit Planning Guide* provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity.

Landscape unit

A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives.

Long-term harvest level

A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.

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Mature seral	Forest stands with trees between 80 and 120 years old, depending on species, site conditions and biogeoclimatic zone.
Management assumptions	Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.
Mean annual increment (MAI)	Stand volume divided by stand age. The age at which average stand growth, or MAI, reaches its maximum is called the culmination age (CMAI). Harvesting all stands at this age results in a maximum average harvest over the long term.
Minimum harvestable age	The age at which a stand of trees is expected to achieve a merchantable condition. The minimum harvestable age could be defined based on maximize average productivity (culmination of mean annual increment), minimum stand volume, or product objectives (usually related to average tree diameter).
Model	An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities.
Natural disturbance type (NDT)	An area that is characterized by a natural disturbance regime, such as wildfires, which affects the natural distribution of seral stages. For example areas subject to less frequent stand-initiating disturbances usually have more older forests.
Not satisfactorily restocked (NSR) areas	An area not covered by a sufficient number of well-spaced trees of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR.
Operability	Classification of an area considered available for timber harvesting. Operability is determined using the terrain characteristics of the area as well as the quality and quantity of timber on the area.

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Person-year(s)	One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years.
Protected area	A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations).
Riparian area	Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.
Scenic area	Any visually sensitive area or scenic landscape identified through a visual landscape inventory or planning process carried out or approved by a district manager.
Sensitivity analysis	A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case.
Seral stages	Sequential stages in the development of plant communities that successively occupy a site and replace each other over time.
Site index	A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground). Site index curves have been developed for British Columbia's major commercial tree species.
Stand-level biodiversity	A stand is a relatively localized and homogeneous land unit that can be managed using a single set of treatments. In stands, objectives for biodiversity are met by maintaining specified stand structure (wildlife trees or patches), vegetation species composition and coarse woody debris levels.
Stocking	The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.
Table Interpolation Program for Stand Yields	A B.C. Forest Service computer program used to generate yield projections for managed stands based on interpolating from yield tables of a model (TASS) that simulates the growth of individual trees based on internal growth processes, crown competition, environmental factors and silvicultural practices.

9 Glossary

Timber harvesting land base	Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology.
Timber supply	The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.
Timber supply area (TSA)	An integrated resource management unit established in accordance with <i>Section 7 of the Forest Act</i> .
Tree farm licence (TFL)	Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.
Ungulate	A hoofed herbivore, such as deer.
Unsalvaged losses	The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested.
Variable Density Yield Prediction model	An empirical yield prediction system supported by the Ministry of Sustainable Resource Management, designed to predict average yields and provide forest inventory updates over large areas (i.e., Timber Supply Areas). It is intended for use in unmanaged natural stands of pure or mixed species composition.
Visual quality objective (VQO)	Defines a level of acceptable landscape alteration resulting from timber harvesting and other activities. A number of visual quality classes have been defined on the basis of the maximum amount of alteration permitted.
Volume estimates (yield projections)	Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands.
Watershed	An area drained by a stream or river. A large watershed may contain several smaller watersheds.
Wildlife tree	A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife.
Woodlot licence	An agreement entered into under the <i>Forest Act</i> . It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis.

Appendix A

Description of Data Inputs and Assumptions for the Timber Supply Analysis

Introduction

The following tables and commentary outline the methods and inputs used to derive the timber harvesting land base, and to construct the timber supply model for the Golden TSA timber supply analysis. This information represents current forest management in the area.

Current management is defined as the set of land-use decisions and forest and stand management practices currently implemented and enforced. Future forest management objectives that may be intended, but are not currently implemented and enforced, are not included in this appendix.

The purpose of the Timber Supply Review is to provide information on the effects of current management on both short- and long-term timber supply in each timber supply area in the province. Any changes in forest management objectives and practices, and any improvements to the data will be included in subsequent timber supply analyses.

More detail on the derivation of many of the land base exclusions and modelling approaches is available in the May 2002 *Golden Timber Supply Area Timber Supply Review Data Package*. This appendix includes any changes to the assumptions contained in the data package that have been made as a result of its public review or any developments in current management that occurred after the data package was published. Any changes are noted in the appropriate section of this appendix.

A.1 Inventory Information

Table A-1. Inventory information

Data	Source	Vintage (yyyy/mm)	Update ^(a) (yyyy/mm)	Source scale
Golden TSA forest cover (Vegetation Resource Inventory(VRI))	Ministry of Sustainable Resource Management (MSRM)	2001/12	N/A	1:20,000
Hamber Provincial Park forest cover (VRI)	MSRM	2001/12	N/A	1:20,000
Cummins Provincial Park forest cover (VRI)	MSRM	2001/12	N/A	1:20,000
Federal (National Park) forest cover (FC1)	MSRM	1996/01	N/A	1:20,000
Land ownership	Ministry of Forests (MoF) — non-standard	1998/10	2002/03	1:20,000
Operability line	MoF District — non-standard	2002/01	N/A	1:20,000
Environmentally sensitive areas (ESA)	MoF District — non-standard	1994/10	N/A	1:20,000
Landscape unit boundaries	MoF District — non-standard	1997/04	2001/12	1:250,000
Biodiversity emphasis (KBHLPO Map 1.1)	MoF District — non-standard	1997/04	N/A	1:250,000
New (1995-1997) protected areas	MoF Victoria RT&E Branch	2001/12	N/A	1:20,000
Biogeoclimatic ecosystem classification	MoF Victoria Research Branch	1999/10	N/A	1:250,000
Connectivity corridors	MSRM Nelson	1997/04	N/A	1:250,000
Caribou habitat map (HLP)	MSRM Nelson	1997/04	N/A	1:250,000
Revised caribou habitat map	MoF Revelstoke Research Branch	2001/12	N/A	1:250,000
Ungulate winter habitat (non-caribou)	MSRM Nelson	1999/04	N/A	1:50,000
Domestic watersheds	MSRM	2001/10	N/A	1:50,000

(continued)

(a) N/A in this table denotes that the information has not been updated since the original collection.

A.1 Inventory Information

Table A-1. Inventory information (concluded)

Data	Source	Vintage (yyyy/mm)	Update ^(a) (yyyy/mm)	Source scale
Visual landscape inventory (NAD83, UTM)	MoF District — non-standard	1998/12	2001/12	1:20,000
Columbia Wildlife Management Area	MSRM Nelson	1996/10	1998/05	1:20,000
Blocks harvested since 1996/97 (2001 Forest Development Plan)	MoF District — non-standard	2001/12	N/A	1:20,000
Category A blocks in 2001 Forest Development Plan	MoF District — non-standard	2001/12	N/A	1:20,000
Slope 80% line derived from TRIM Grid	MoF District — non-standard	2002/04	N/A	1:20,000
Roads	MoF District — non-standard	1998/12	N/A	1:20,000
Stream classes	MSRM Nelson — Watershed Atlas data transferred to TRIM base	2002/05	N/A	1:20,000

(a) N/A in this table denotes that the information has not been updated since the original collection.

Data source and comments:

Forest cover

The Golden TSA Vegetation Resource Inventory (VRI) is based on 1996/97 photos. Disturbances to forest cover after 1996/97 are identified on the 2001 Forest Development Plan map. The database was projected for growth and aging to January 2003.

Land ownership

Land ownership files have been updated to include new woodlot licenses and deletions of timber licenses.

Environmentally sensitive areas (ESAs)

The environmentally sensitive area classification was taken from FC1 files.

Revised caribou habitat map

The revised caribou habitat map is based on agreements made by the Regional Caribou Committee. These revisions have not been incorporated into the June 14th new higher level plan.

A.1 Inventory Information

2001 forest development plan maps

The forest development plan maps provided the following information:

- blocks harvested since 1996/97;
- blocks partially cut;
- category A blocks;
- category A blocks on timber licenses.

Roads

Roads are based on TRIM data which has been updated from 1996/97 photography.

Enhanced resource development zones

Timber ERDZs (ERDZ-T) described in *Objective 7* of the *KBHLPO* have not been incorporated for the following reasons: (1) there are many fragmented ERDZ-Ts, some of which are very small and difficult to manage (2) landscape unit patch size objectives have not been established.

A.2 Zone and Analysis Unit Definitions

A.2.1 Management zones (groups)

Management zones represent areas with distinct management emphasis. For example, a zone may be based on a harvesting system, silvicultural system, visual quality objective or wildlife consideration. Some areas may be subject to more than one management objective. Grouping enables the analyst to apply overlapping constraints to such areas.

Table A-2 provides general descriptions of the management objectives and related information to be tracked in the analysis. The non-contributing forest (i.e., forested land not available for timber harvesting) is taken into account when modelling forest cover objectives for landscape-level biodiversity, wildlife, scenic and water values. Table A-3 provides a land base summary of the objectives to be tracked. Further information on the forest cover requirements to be applied to these areas can be found in Section A.4.11, "Forest cover requirements."

Table A-2. Objectives to be tracked

Objective	Definition
Landscape-level biodiversity requirements	Established landscape units and biodiversity emphasis options and associated old and old plus mature seral stage targets as per <i>Objectives 1 and 2</i> of the <i>Kootenay-Boundary Higher Level Plan Order (KBHLPO)</i> .
Caribou management	Age class 8 and 9 area targets specified in <i>Objective 3</i> of the <i>KBHLPO</i> for the ESSF and ICH biogeoclimatic zones having identified caribou areas with slopes less than 80 per cent.
Ungulate winter range (UWR) habitat cover requirements	Forest cover requirements on the updated <i>Kootenay-Boundary Land Use Plan (KBLUP)</i> ungulate winter range mapping.
Maintenance of scenic values	Green-up requirements in visual landscape areas which reflect Class 1 and 2 scenic areas as described in <i>Objective 9</i> of the <i>KBHLPO</i> .
Water — domestic watershed management	Green-up requirements in domestic watersheds.
Integrated resource management	Green-up requirements in areas where harvesting operations are not otherwise constrained by other cover objectives (except biodiversity).
North/south split	Landscape units G1 through G12 and G29 form the north part of the TSA. All other landscape units form the south part.
Partial cutting	Areas where partial cutting predominately occurs in the MSdk and ICHmk1 subzones of landscape units G20, G21, G23, G25, G26, G27 and G28. See Section A.4.6.

A.2 Zone and Analysis Unit Definitions

Table A-3. Land base summary by objectives (groups) to be tracked

Objective	Gross area (ha)	CFLB (ha)	% CFLB	THLB (ha)	% THLB
Landscape-level biodiversity					
G-1 — Upper Wood	74 823.5	11 817.2	2.7	1 973.0	1.3
G-2 — Molson	21 785.0	8 007.2	1.9	3 853.4	2.5
G-3 — Lower Wood	24 926.2	12 395.0	2.9	5 109.2	3.3
G-4 — Tsar	38 827.2	18 094.9	4.2	4 861.6	3.2
G-6 — Kinbasket	26 307.9	4 711.0	1.1	1 506.1	1.0
G-7 — Sullivan	64 023.2	14 168.6	3.3	4 586.2	3.0
G-8 — Foster/Garrett	31 240.2	14 227.4	3.3	6 821.5	4.4
G-9 — Chatter/Prattie	34 193.7	12 138.1	2.8	3 805.0	2.5
G-10 — Bush River	59 942.7	14 289.7	3.3	4 690.0	3.0
G-11 — Goosegrass	15 612.2	5 660.1	1.3	2 031.5	1.3
G-12 — Windy/Austerity	26 174.7	5 058.5	1.2	556.9	0.4
G-13 — Bachelor	56 027.7	16 512.6	3.8	4 753.7	3.1
G-14 — Ventego	67 466.3	18 623.3	4.3	2 038.6	1.3
G-15 — Esplanade	15 908.4	9 684.3	2.2	4 995.4	3.2
G-16 — Blackwater Ridge	34 303.4	25 854.9	6.0	19 176.9	12.5
G-17 — Hope/Goodfellow	20 173.7	10 350.8	2.4	3 807.5	2.5
G-18 — Valenciennes	31 431.0	7 102.7	1.6	2 428.5	1.6
G-19 — Bluewater/Waitabit	51 378.8	13 300.6	3.1	822.0	0.5
G-20 — Moberly	37 448.2	18 996.5	4.4	7 681.6	5.0
G-21 — Blaeberry	69 287.3	28 102.7	6.5	9 660.8	6.3
G-22 — Quartz	37 242.0	18 059.0	4.2	7 554.7	4.9
G-23 — West Bench	44 113.5	24 204.5	5.6	14 341.4	9.3
G-24 — Canyon	12 932.8	4 855.5	1.1	54.3	0.0
G-25 — Mount 7	13 207.2	5 662.9	1.3	1 598.8	1.0
G-26 — Kicking Horse/Beaverfoot	155 864.6	53 287.6	12.4	10 016.5	6.5
G-27 — Moose	20 132.5	8 444.6	2.0	4 175.8	2.7
G-28 — Kootenay	51 091.9	31 752.2	7.4	15 957.3	10.4
G-29 — Swan	23 809.6	10 757.1	2.5	5 011.4	3.3
G-38 — Glacier National Park	25 425.9	4 495.5	1.0	0.0	0.0
Landscape level biodiversity	1 185 101.1	430 615.0	100.0	153 869.7	100.0
Caribou habitat (TSA only)					
ESSF above 1994 operability line	36 889.4	12 603.6	3.6	227.5	0.1
ESSF below 1994 operability line	6 641.7	5 845.8	1.7	3 048.7	2.0
ICH above 1994 operability line	5 922.7	3 004.0	0.8	264.0	0.2
ICH below 1994 operability line	26 515.0	22 392.7	6.3	17 190.5	11.2
Caribou habitat	75 968.8	43 846.1	12.4	20 730.6	13.5
Ungulate winter range (TSA only)	75 038.3	48 830.9	13.8	35 237.4	22.9
Scenic values (TSA only)					
Retention VQO	4 876.9	2 948.0	0.8	1 763.1	1.1
Partial Retention VQO	30 097.6	23 669.8	6.7	14 396.4	9.4
Modification VQO	16 256.2	9 470.9	2.7	3 869.0	2.5
Scenic values	51 230.8	36 088.7	10.2	20 028.5	13.0
Domestic watersheds (TSA only)	38 073.4	17 758.2	5.0	5 951.1	3.9
Integrated resource management	N/A	N/A	N/A	80 678.0	52.4
North part of TSA	394 672.2	117 405.8	33.2	44 805.8	29.1
South part of TSA	507 772.4	236 527.8	66.8	109 063.8	70.9
Partial cutting zone	N/A	N/A	N/A	17 193.6	11.1

A.2 Zone and Analysis Unit Definitions

A.2.2 Analysis unit characteristics

An analysis unit represents a group of stands dominated by specific tree species having a specific timber growing capability—as indicated by the inventory type group (ITG) and site index in the forest inventory file. Each analysis unit is assigned its own timber volume projections (yield tables). Timber volume projections are made for each group of stands within an analysis unit having the same status. A stand's status may be the following:

- Natural — defined as an existing stand older than 25 years, or the coniferous understory component of a deciduous leading stand age 25 years or younger, or any backlog stand; or
- Managed — defined as an existing stand age 25 years or younger (recent plantation), or any future, regenerated non-backlog stand.

Yield tables for natural stands were derived using the variable density yield projection (VDYP) growth and yield model. Yield tables for managed stands were derived using the table interpolation program for stand yields (TIPSY).

A stand was assigned an analysis unit number and a yield table number for grouping purposes. Table A-4 shows the coding scheme used in the analysis for deriving these numbers.

Table A-4. Coding scheme for deriving analysis unit and yield table numbers

Stand status code ^a and description	Species group code ^a and description	Site group code ^a and description
1 – natural	1 – fir leading (dry)	1 – good (upper site index range)
2 – managed	2 – fir leading (wet)	2 – medium (middle site index range)
8 – road right-of-way	3 – cedar leading	3 – lower medium or poor (lower middle or lower site index range)
9 – outside of CFLB	4 – hemlock leading	4 – poorer (lower site index range)
	5 – balsam, spruce predominant	5 – backlog 1 (statistically defined using ISIS — $\geq 60\%$ MSS ^b)
	6 – spruce mixed	6 – backlog 2 (statistically defined using ISIS — $< 60\%$ MSS)
	7 – pine leading	
	8 – deciduous leading	
	0 – not grouped by species	0 – not grouped by site category

(a) Example: analysis unit number 11 would be assigned to a fir leading (dry) stand growing on a good site. If that stand is of natural origin it would be assigned yield table number 111. If that stand is managed it would be assigned yield table number 211.

(b) MSS = minimum stocking standard.

Tables A-5. and A-6. show the defining inventory criteria and some statistics for each analysis unit.

A.2 Zone and Analysis Unit Definitions

Table A-5. Definition of analysis units

Species group code ^a	Site index group ^d (m@ 50 yrs)	Analysis unit number	Inventory type groups	Timber harvesting land base
F (dry)	≥ 22	11	F, F&PI, F&Py, F&L, F&Decid, L&F, L	3 679.5
	≥ 17 to < 22	12	(1, 5, 6, 7, 8, 33, 34)	11 783.7
	< 17	13		3 144.3
F (wet)	≥ 21	21	F&C, F&H, F&S	2 670.9
	≥ 17 to < 21	22	(2, 3, 4)	9 052.5
	< 17	23		4 845.3
C	≥ 19	31	C, C&F, C&H	3 565.5
	≥ 14 to < 19	32	(9, 10, 11)	7 730.7
	< 14	33		1 583.1
H	≥ 18	41	H, H&F, H&C, H&B, H&S, H&Decid	2 070.8
	≥ 14 to < 18	42	(12, 13, 14, 15, 16, 17)	2 803.7
	< 14	43		6 567.1
B, S S pre-dominant	≥ 18	51	B, B&H, B&S, S, S&B	5 787.9
	≥ 13 to < 18	52	(18, 19, 20, 21, 24)	20 163.6
	< 13	53		8 073.5
S mixed	≥ 21	61	S&F, S&H, S&PI, S&Decid	4 449.9
	≥ 17 to < 21	62	(22, 23, 25, 26)	6 693.8
	≥ 13 to < 17	63		12 521.6
	< 13	64		2 835.6
P	≥ 21	71	Pw&Pa, PI, PI&F, PI&S, PI&Decid, Py	4 792.2
	≥ 19 to < 21	72	(27, 28, 29, 30, 31, 32)	4 565.9
	≥ 16 to < 19	73		15 383.7
	< 16	74		1 800.6

(continued)

A.2 Zone and Analysis Unit Definitions

Table A-5. Definition of analysis units (concluded)

Species group code ^a	Site index group ^d (m@ 50 yrs)	Analysis unit number	Inventory type groups	Timber harvesting land base
Deciduous ^b	≥ 16	81	Cot&Conif, Cot&Decid, D&Conif,	3 354.0
	≥ 12 to < 16	82	D&Decid, Mb, Bi, A&Conif, A&Decid	152.8
	< 12	83	(35, 36, 37, 38, 39, 40, 41, 42)	34.5
Backlog 1 ^c	≥ 60% MSS	05	Statistically defined using ISIS profile	3 445.0
Backlog 2	< 60% MSS	06	Statistically defined using ISIS profile	318.0
Total				153 869.7

(a) Letter codes taken from the Vegetation Resources Inventory B.C. Land Cover Classification Scheme Document.

(b) Most deciduous types (age > 25 years) are removed from the timber harvesting land base (see Section A.3.6).

(c) See Section A.4.10 for more information on backlog not satisfactorily restocked (NSR) areas.

(d) Only stands with a site index higher than the low site definition in Section A.3.5 are in the timber harvesting land base.

A.2 Zone and Analysis Unit Definitions

Table A-6. Analysis unit statistics

Species group code	Site index group (m @ 50 years)	Avg. SI @ 50 years	Maximum MAI ^a (m ³ /ha/year)		Current timber harvesting land base status (hectares)		
			VDYP	TIPSY	Age ≤ 25 years	Age > 25 years	
					Plantation/managed	Clearcut system	Partial cut system
F dry	≥ 22	23.7	3.38	5.53	92.0	2 387.0	1 200.5
	≥ 17 to < 22	18.5	2.20	3.42	2 231.0	7 674.0	1 878.8
	< 17	15.3	1.81	2.25	595.1	2 039.9	509.3
F wet	≥ 21	23.4	4.09	5.32	199.6	1 948.7	522.7
	≥ 17 to < 21	18.6	2.97	3.56	1 262.1	6 676.4	1 114.0
	< 17	15.5	2.23	2.10	401.0	4 109.4	334.8
C	≥ 19	19.2	2.82	4.74	2 823.4	742.1	0.0
	≥ 14 to < 19	15.8	2.68	3.49	723.8	7 006.9	0.0
	< 14	12.6	1.91	2.39	230.4	1 352.7	0.0
H	≥ 18	18.7	4.17	4.50	878.6	1 192.2	0.0
	≥ 14 to < 18	15.2	2.80	3.97	88.6	2 715.0	0.0
	< 14	12.1	2.16	2.23	176.4	6 390.7	0.0
B, S							
S pre-dominant	≥ 18	20.8	3.15	4.95	443.8	4 177.4	1 166.7
	≥ 13 to < 18	15.1	2.12	3.19	9 304.2	9 562.5	1 296.9
	< 13	10.8	1.56	2.06	1 088.3	6 874.2	110.9
S mixed	≥ 21	23.7	3.88	5.51	313.5	3 187.0	949.4
	≥ 17 to < 21	18.7	3.18	3.96	507.9	4 334.3	1 851.6
	≥ 13 to < 17	15.1	2.51	3.04	5 920.8	5 401.0	1 199.8
	< 13	11.2	2.09	2.26	403.9	2 309.6	122.1

(continued)

A.2 Zone and Analysis Unit Definitions

Table A-6. Analysis unit statistics (concluded)

Species group code	Site index group (m @ 50 years)	Avg. SI @ 50 years	Maximum MAI ^a (m ³ /ha/year)		Current timber harvesting land base status (hectares)		
			VDYP	TIPSY	Age ≤ 25 years	Age > 25 years	
					Plantation/managed	Clearcut system	Partial cut system
P	≥ 21	22.6	3.88	5.32	178.4	2 902.5	1 711.3
	≥ 19 to < 21	19.9	3.26	4.33	75.9	3 002.2	1 487.8
	≥ 16 to < 19	16.6	2.39	3.08	6 430.2	7 363.4	1 590.1
	< 16	14.6	2.27	2.47	165.4	1 488.3	146.9
Deciduous	≥ 16	20.1	2.14	4.80	3 076.3	277.8	0.0
	≥ 12 to < 16	13.9	1.49	2.96	129.9	22.9	0.0
	< 12	10.8	1.24	2.08	34.5	0.0	0.0
Backlog 1	≥ 60% MSS	17.0	2.45	2.45	3 445.0	0.0	0.0
Backlog 2	< 60% MSS	17.0	2.04	2.04	318.0	0.0	0.0
Average		17.0	2.583	3.477			
Total					41 538.0	95 138.1	17 193.6

(a) MAI = mean annual increment calculated on entire analysis unit area assigned to yield table.

A.3 Definition of the Timber Harvesting Land Base

This section outlines the steps used to identify the timber harvesting land base (the productive forest expected to support timber harvesting) within the Golden TSA and within the Golden analysis area. Land may be unavailable for timber harvesting for three principle reasons:

- it is not administered by the Forest Service for timber supply (e.g., private land, parks, etc.);
- it is not suitable for timber production; or
- it is required for other forest values.

The classification of 'unavailable for timber harvesting' applies only to land where no harvesting is anticipated. Any area in which some timber harvesting is expected to occur remained in the timber harvesting land base, even if the area is subject to management constraints. Such constraints were represented in the timber supply analysis.

After all areas that do not contribute to the timber harvesting land base were identified, the resulting land base was defined as the "current timber harvesting land base" for the Golden TSA.

A.3.1 Land not administered by the British Columbia Forest Service for timber supply

Ownership codes were used to identify whether the land was considered to contribute to timber supply. Generally, only ownership codes 62C and 69C contribute to the TSA timber supply. These codes indicate Crown land in a forest management unit and miscellaneous reserves (including recreation sites), respectively. Ownership code 70N indicates land in a timber licence. When timber licenses expire these areas revert to Crown land contributing to timber supply. Areas with other ownership codes were removed from the land base currently considered available for timber supply.

A.3 Definition of the Timber Harvesting Land Base

Table A-7. Land base summary by ownership code

Ownership classification		Area within Golden TSA (hectares)	Area within park > 100 ha (hectares)	Total area within Golden analysis area (hectares)	Land not managed for timber supply within Golden analysis area (ha)
Code	Description				
40-N	Private	13 512.1	0.0	13 512.1	13 512.1
51-N	National Park	0.0	235 662.8	235 662.7	235 662.7
	Glacier — 87 682.1 ha				
	Kootenay — 18 911.9 ha				
	Yoho — 129 068.7 ha				
60-N	Ecological reserve	2 730.8	0.0	2 730.8	2 730.8
61-C	Use recreation & enjoyment of the Public (UREP)	1 192.5	0.0	1 192.5	1 192.5
61-N	UREP	623.3	0.0	623.3	623.3
62-C	Forest management unit	868 551.0	0.0	868 551.0	718 710.0 ^a
62-N	Timber Agreement land	23.7	0.0	23.7	23.7
63-N	Provincial Park, class A	723.2	46 993.7	47 716.9	47 716.9
	Cummins — 21 656.0 ha				
	Hamber — 25 337.7 ha				
69-C	Miscellaneous reserves	206.7	0.0	206.7	115.9 ^a
70-N	Timber licence in a TSA	5 459.4	0.0	5 459.4	1 521.6 ^a
77-N	Woodlot licence	7 778.8	0.0	7 778.8	7 778.8
99-N	Miscellaneous leases	1 638.1	0.0	1 638.1	1 638.1
Total		902 444.6	282 656.5	1 185 101.0	1 031 231.4

(a) After all factors considered.

A.3 Definition of the Timber Harvesting Land Base

A.3.2 Land classified as non-vegetated, non-treed, sparsely treed or unproductive

For areas outside silvicultural openings and the 2001 Forest Development Plan, the B.C. land cover classification coding system was used to identify land not vegetated or not treed. These categories include areas occupied by lakes, rivers, ice, road beds, shrubs and herbs, and do not contribute to timber supply. Any treed (T) area having a crown closure of less than 25% and not having a land cover code of dense (DE) or open (OP), and any treed area having a site index of less than 8, was considered sparsely treed or unproductive. Sparsely treed and unproductive areas do not contribute to timber supply or landscape unit biodiversity requirements.

Land within silvicultural openings and the 2001 Forest Development Plan (blocks harvested since 1996/97, category A blocks, cutting permits) was considered part of the working forest regardless of its current B.C. land cover classification code.

Table A-8. Non-vegetated, non-treed, sparsely treed or unproductive land

Broad BC land cover classification	Description	Area removed (hectares)
Water	Lake	32 556.7
	River or stream	4 477.0
Non-vegetated land	Rock	181 195.1
	Snow and ice	87 651.4
	Exposed soil	1 797.2
	Road or railway bed	275.4
	Moraine or river sediment	210.9
	Gravel pit	32.0
	Other	123.0
Vegetated land — non-treed	Shrubs	78 970.8
	Herbs	68 163.9
	Bryoid	684.8
Vegetated land — treed	Sparsely treed or unproductive	66 372.8
Unreported	None available	256.2
Total		522 767.2

A.3 Definition of the Timber Harvesting Land Base

A.3.3 Inoperable areas

Operability codes are generally based on the presence or absence of physical barriers or limitations to harvesting, the appropriate logging methods (e.g., cable), and the merchantability of stands. Table A-9. describes the treatment of operability classes when defining the timber harvesting land base.

Table A-9. Description of inoperable areas

Inventory description	Code	Reduction per cent (%)	Reduction area (ha)
Inoperable	I	100	164 952.3
Operable	A	0	0.0
Total			164 952.3

Note: Any area within a mapped harvest block, category A block or cutting permit is considered operable regardless of the operability code.

Data source and comments:

The operability line for the TSA was updated in 2002. Before the update, about 219 180 hectares were classified as operable based on 1999 line work. After the update about 14% less area was considered operable, mostly because of the exclusion of marginal and uneconomic stands.

A.3.4 Environmentally sensitive areas

Some forest lands are environmentally sensitive or significantly valuable for other resources. These areas have been identified and delineated a forest inventory as environmentally sensitive areas (ESAs). The ESA system uses the following categories: soil (Es), forest regeneration problems (Ep), snow avalanche (Ea), recreation (Er), wildlife (Ew), water (Eh) and fisheries (fisheries symbols). In the context of timber supply analysis, ESAs may result in a reduction in the harvesting opportunity on these sites.

Table A-10. identifies the proportion of ESAs in various categories that are unavailable for harvesting.

Table A-10. Land base exclusions for environmentally sensitive areas

ESA category	ESA description	Reduction per cent	Reduction area (hectares)
Es1	Highly sensitive soils	90	6 165.7
Ea1	High snow avalanche hazard	100	14.7
Es2	Moderately sensitive soils	10	57.4
Total			6 237.8

Data source and comments:

The environmentally sensitive area classification was taken from FCI files.

A.3 Definition of the Timber Harvesting Land Base

A.3.5 Sites with low timber growing potential

Sites may have low productivity either because of inherent site factors (nutrient availability, exposure, excessive moisture, etc.) or because they are not fully occupied by commercial tree species. As these stands were not considered to be harvestable, they were identified and removed from the timber harvesting land base.

Table A-11. Description of sites with low timber growing potential

Leading species	Tree genus or species code	Inventory type group	Site index	Reduction per cent	Reduction area (hectares)
Douglas-fir	F	1 - 8	< 9	100	0.0
Cedar	C	9 - 11	< 9	100	83.3
Hemlock	H	12 - 17	< 8	100	344.4
Balsam	B	18 - 20	< 8	100	319.3
Spruce	S	21 - 26	< 8	100	973.7
White pine	Pw	27	< 9	100	0.0
Lodgepole pine	Pl	28 - 31	< 9	100	62.7
Ponderosa pine	Py	32	< 9	100	0.0
Larch	L	33, 34	< 9	100	0.0
Deciduous ^a	A, E	35 - 42	< 9	100	33.0
Unknown (no ITG)	Blank	0, blank	< 9	100	916.9
Total					2 733.3

(a) Most deciduous types (age > 25 years) of all site indices are removed from the timber harvesting land base.

Note: Any area within a mapped harvest block, category A block or cutting permit is included in the timber harvesting land base regardless of site index.

Data source and comments:

The site indices in the above table represent stands between 150 and 200 years of age where the average DBH is less than 25 cm.

A.3 Definition of the Timber Harvesting Land Base

A.3.6 Problem forest types

Problem forest types are stands that are physically operable and exceed low site criteria yet are not currently utilized. These types were excluded from the timber harvesting land base. Examples are hemlock stands that contain a high proportion of decadent wood, and deciduous stands.

Table A-12. Problem forest types criteria

Inventory type groups	Age (years)	Leading species (sp1)	Reduction per cent	Reduction area (hectares)
H, H&F, H&C, H&B, H&S, H&Dec (12, 13, 14, 15, 16, 17)	> 140	≥ 80%	100	984.9
Cot&Conifer, Cot&Decid, D&Conif, D&Decid, Mb, Bi, A&Conifer, A&Decid (35, 36, 37, 38, 39, 40, 41, 42)	> 25	N/A	100	5 842.7
Total				6 827.6

Note: Any area within a mapped harvest block or category A block is included in the timber harvesting land base.

A.3 Definition of the Timber Harvesting Land Base

A.3.7 Roads, trails and landings (RTLs)

Separate estimates were made to reflect the loss of productive forest to existing roads, trails and landings and future RTLs. Existing road estimates were applied as reductions to the current productive forest considered available for harvesting. Future road estimates were applied after stands are harvested for the first time in the simulation model.

All highways and some larger municipal roads are of a sufficient size to be mapped as polygons and classified and excluded as non-vegetated areas. The area occupied by various rights-of-way (e.g., secondary roads) too small to be mapped as separate polygons was determined by overlaying right-of-way geographic information system (GIS) buffers created from the district roads map with vegetation resource inventory (VRI) resultant polygons. For each VRI resultant polygon, the area of right-of-way to be deducted from the polygon area was determined by the length of the right-of-way intersected and an associated right-of-way width.

Table A-13. Estimates for existing and future roads, trails, and landings

Location	Age (years)	Right-of-way width (metres)	Reduction per cent	Area removed (hectares)
Existing secondary roads (Class 2)	N/A	14	N/A	3 057.4
Landings, trails and deactivated roads	N/A	N/A	3.0	N/A
Future roads	> 25	N/A	6.1	6 617.8

Data source and comments:

Existing roads have been captured in a district non-standard overlay. This overlay captures roads from TRIM data that has been updated by 1996/97 photography. Three classes of roads have been defined. Class 1 designates highways and secondary roads. Most of these are not part of the productive land base so no reduction is applied. Class 2 roads designate logging roads. A 14-metre road right-of-way buffer has been applied to these roads. Class 3 roads apply to trails or deactivated roads. A 3% reduction to volume tables was applied to account for productivity losses associated with landings, trails and deactivated roads. ISIS data shows that the amount of area lost to permanent access on average over the past 5 years was about 6.1% in each treatment unit. It is assumed this trend will continue into the future.

A.3.8 Wildlife habitat

In the *Managing Identified Wildlife: Procedures and Measures Volume 1*, management prescriptions include core "no harvesting" areas around nesting sites or other valuable habitats for endangered species. If prescriptions are approved by government, the areas would be removed from the timber harvesting land base. However, while wildlife management areas have been proposed for goshawk and goat in the Golden TSA, no wildlife management areas have been established.

Forest cover requirements were applied for caribou habitat and ungulate winter range (including the Columbia Management Area).

Avalanche tracks important to grizzly bears have not been identified. Once identified these areas would be given a preference for deploying the biodiversity old and mature seral budget as described in *Objective 5* of the KBHLPO.

A.3 Definition of the Timber Harvesting Land Base

A.3.9 Cultural heritage resources

Cultural heritage values include trap line and sites of archaeological or traditional use.

An archaeological overview assessment (AOA) was completed for the Golden TSA in 1996. Since then, a number of field-based site specific archaeological impact assessments (AIA) have been made on some medium to high potential areas identified in the AOA. These assessments have not resulted in any appreciable decrease to the area available for timber harvesting.

A.3.10 Riparian reserve and management zones

Management in riparian areas were accounted for through an area deduction. Table A-14. indicates the widths of riparian buffers used to exclude area from the timber harvesting land base to account for management in riparian areas. While some harvesting may occur in riparian management zones, an effective reserve can be calculated by multiplying the management zone width by the retention percentage. The total riparian area reserve consists of the reserve zone plus the effective reserve constituted by the management zone.

The area occupied by various riparian area reserves was determined by overlaying GIS riparian area reserve buffers with vegetation resource inventory (VRI) resultant polygons. For each VRI resultant polygon, the riparian area reserve buffer to be deducted from the polygon area was determined by the length of a riparian feature within the resultant polygon and an associated riparian area reserve width. Where riparian buffers overlapped with road buffers the overlapping area was attributed to the road buffer.

Table A-14. *Riparian reserve zones*

Riparian class	Reserve width (metres)	Management zone width (metres)	Retention in management zone (%)	Total riparian area reserve width ^a (metres)
S1	50	20	50	60
S2	30	20	50	40
S3	20	20	50	30
S4	0	30	25	7.5
S5	0	30	25	7.5
S6	0	20	5	1
W1	10	40	25	20
W3	0	30	25	7.5
W5	10	40	25	20
L1	10	100	50	60
L3	0	30	25	7.5

(a) The reserve width for riparian classes S1 to S6 is applied to each side of the stream.

A.3 Definition of the Timber Harvesting Land Base

Data source and comments:

The riparian information used for the last timber supply review was reviewed by district and Ministry of Sustainable Resource Management staff, and revisions made. District staff used the inventories reflected in the current Forest Development Plan to update stream classes 1 to 3. Not all the S4 and S6 streams were captured in the inventory due to their small size.

The forested portion of the riparian area reserve is treated in the analysis as part of the operable non-contributing or the inoperable forest (as dictated by the operability line).

A.3.11 Exclusion of specific, geographically defined areas

No specific geographically defined areas were excluded from the timber harvesting land base.

A.3.12 Timber licence reversions

Timber licences are old tenure arrangements that give a licensee exclusive rights to harvest merchantable timber within the licence area and do not contribute to the TSA allowable annual cut. Once these areas have been harvested, regenerated, and have attained free-growing status, the timber licence area reverts to Forest Service jurisdiction. Accordingly, these areas are included in the timber harvesting land base after the first harvest and contribute to the TSA harvests in the medium to long term.

Table A-15. Timber licence reversion schedule

Timber licence #	Location	Expiry year	Area to be harvested under the current forest development plan (hectares)
541	Palliser	2008	105
550	Alder Creek	2003	N/A
606	Blaeberry	2005	N/A
179	Beaver River	2002	84

Data source and comments:

Only four timber licenses exist in the Golden TSA and the last of these agreements expires in 2008. It is assumed that only the areas under cutting permit or with category A approval will be harvested prior to expiry. The volume harvested will not contribute to the timber supply for the TSA. Otherwise all areas in these timber licenses will contribute to the TSA's timber supply and will be included in the calculation regarding forest cover objectives.

A.4 Forest Management Assumptions

A.4.1 Woodlots

The current AAC for the Golden TSA — as determined May 6, 1999 — is 530 000 cubic metres per year. Since the 1999 AAC determination, no timber volume has been allocated to new or expanded woodlot licences. Therefore, for this analysis the current harvest level for the TSA (which excludes allocated woodlot licences) is considered to be 530 000 cubic metres per year.

A.4.2 Utilization levels

The utilization levels define the maximum stump height, minimum top diameter (inside bark) and minimum diameter at breast height (dbh) by species used in the analysis to calculate merchantable volume.

Table A-16. Utilization levels

Analysis unit	Utilization		
	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Pine or deciduous	12.5	30	10
Not pine or deciduous	17.5	30	10 ^a

(a) Minimum top dib of 10 cm applies to most of the units. In practice cedar older than 140 years is utilized to a minimum top dib of 15 cm, however, volumes to a 10-cm top are counted against cut control.

A.4.3 Volume exclusions for mixed species stands

Deciduous species are not normally harvested in the Golden TSA, even when volumes are taken from deciduous-leading stands. The unharvested portion of stands do not contribute to the estimated stand volume. In some instances the deciduous trees left standing may contribute to biodiversity stand level objectives. These are accounted in the wildlife tree requirements described in Section A.4.12.

Table A-17. Volume exclusions for mixed species types

Inventory type group	Species	Volume exclusion (%)
All	Any deciduous	100

A.4 Forest Management Assumptions

A.4.4 Minimum harvestable age derivation

The minimum harvestable age is the age at which a stand is considered to be harvestable. While harvesting may occur in stands at the minimum ages in order to meet forest level objectives (e.g., maintaining overall harvest levels for a short period of time or avoiding large changes in harvest levels), most stands will not be harvested until past the minimum ages because of management objectives for other resource values (e.g., requirements for the retention of older forest).

A stand's minimum harvestable age was defined by the years required for it to achieve a minimum diameter, a minimum volume and 95% of its culmination mean annual increment. Table A-18. shows the minimum harvestable ages used in the analysis.

Table A-18. Minimum harvestable ages

Status	Species group code	Site Index group (m@50 yrs)	Yield table number	Years to achieve				
				CMAI ^a	95% of CMAI	Min. DBH ^b	Min. volume ^c	Minimum harvestable age (MHA)
Natural (VDYP)	F dry	≥ 22	111	94	90	60	60	90
		≥ 17 to < 22	112	122	110	70	80	110
		< 17	113	130	115	80	100	115
	F wet	≥ 21	121	101	90	60	55	90
		≥ 17 to < 21	122	113	100	70	70	100
		< 17	123	125	110	80	80	110
	C	≥ 19	131	110	80	60	80	80
		≥ 14 to < 19	132	123	90	70	90	90
		< 14	133	137	100	85	125	125
	H	≥ 18	141	97	80	60	60	80
		≥ 14 to < 18	142	120	90	80	90	90
		< 14	143	145	130	90	120	130
	B, S							
	S pre-dominant	≥ 18	151	96	80	65	65	80
		≥ 13 to < 18	152	124	115	80	90	115
		< 13	153	163	150	115	120	150

(continued)

(a) CMAI = culmination mean annual increment.

(b) Minimum DBH (diameter breast height) = 20 cm for P, Deciduous species groups, 25 cm for others.

(c) Minimum volume = 200 m³/ha for C, H species groups, 150 m³/ha for others.

A.4 Forest Management Assumptions

Table A-18. Minimum harvestable ages

Status	Species group code	Site index group (m@50 yrs)	Yield table number	CMAI ^a	Years to achieve		Min. DBH ^b	Min. volume ^c	Minimum harvestable age (MHA)
					95% of CMAI				
Natural (VDYP)	S mixed	≥ 21	161	92	80		60	60	80
		≥ 17 to < 21	162	110	95		70	70	95
		≥ 13 to < 17	163	130	120		80	80	120
		< 13	164	155	150		100	100	150
	P	≥ 21	171	73	60		50	50	60
		≥ 19 to < 21	172	82	70		60	60	70
		≥ 16 to < 19	173	98	80		70	70	80
		< 16	174	115	100		85	80	100
	Deciduous	≥ 16	181	75	70		50	90	90
		≥ 12 to < 16	182	113	100		70	120	120
		< 12	183	140	120		90	150	150
	Backlog 1	N/A	105	130	130		110	90	130
	Backlog 2	N/A	106	130	130		110	100	130

(continued)

(a) CMAI = culmination mean annual increment.

(b) Minimum DBH (diameter breast height) = 20 cm for P, Deciduous species groups, 25 cm for others.

(c) Minimum volume = 200 m³/ha for C, H species groups, 150 m³/ha for others.

A.4 Forest Management Assumptions

Table A-18. Minimum harvestable ages

Status	Species group code	Site index group (m@ 50 yrs)	Yield table number	CMAI ^a	Years to achieve			
					95% of CMAI	Min. DBH ^b	Min. volume ^c	Minimum harvestable age (MHA)
Managed (TIPSY)	F dry	≥ 22	211	70	60	50	45	60
		≥ 17 to < 22	212	95	80	75	60	80
		< 17	213	110	90	105	80	105
	F wet	≥ 21	221	80	65	55	50	65
		≥ 17 to < 21	222	100	85	75	65	85
		< 17	223	120	95	110	85	110
	C	≥ 19	231	95	80	70	60	80
		≥ 14 to < 19	232	120	95	90	80	95
		< 14	233	135	120	120	105	120
	H	≥ 18	241	100	80	75	65	80
		≥ 14 to < 18	242	115	100	85	75	100
		< 14	243	145	125	130	110	130
	B, S							
	S pre-dominant	≥ 18	251	80	70	60	55	70
		≥ 13 to < 18	252	110	100	90	75	100
		< 13	253	155	135	125	105	135

(continued)

(a) CMAI = culmination mean annual increment.

(b) Minimum DBH (diameter breast height) = 20 cm for P, Deciduous species groups, 25 cm for others.

(c) Minimum volume = 200 m³/ha for C, H species groups, 150 m³/ha for others.

A.4 Forest Management Assumptions

Table A-18. Minimum harvestable ages (concluded)

Status	Species group code	Site index group (m@50 yrs)	Yield table number	CMAI ^a	Years to achieve			
					95% of CMAI	Min. DBH ^b	Min. volume ^c	Minimum harvestable age (MHA)
Managed (TIPSY)	S mixed	≥ 21	261	75	65	55	50	65
		≥ 17 to < 21	262	95	80	70	60	80
		≥ 13 to < 17	263	110	100	90	75	100
		< 13	264	155	130	115	95	130
	P	≥ 21	271	65	55	45	40	55
		≥ 19 to < 21	272	75	60	55	50	60
		≥ 16 to < 19	273	90	70	70	60	70
		< 16	274	110	85	85	75	85
	Deciduous	≥ 16	281	80	75	55	55	75
		≥ 12 to < 16	282	120	105	85	80	105
		< 12	283	165	140	110	110	140

(a) CMAI = culmination mean annual increment.

(b) Minimum DBH (diameter breast height) = 20 cm for P, Deciduous species groups, 25 cm for others.

(c) Minimum volume = 200 m³/ha for C, H species groups, 150 m³/ha for others.

A.4 Forest Management Assumptions

A.4.5 Harvest scheduling priorities

Stands making up cutting permit areas and category A blocks were given first priority for harvest. Stands to be 'beetle proofed' in the partial cutting zone had second priority for harvest. Spruce- or cedar-leading stands in the northern landscape units and fir- or pine-leading in the southern landscape units, outside of cutting permit areas, were assigned third priority for harvest as a group. Finally, if the harvest target could not be met from the previous groups, the remaining stands above minimum harvestable age were prioritized for harvest as a group. Harvest priority of stands within the groups was relative oldest first (i.e., harvest of stands the greatest number of years above minimum harvestable age).

Table A-19. Priorities for scheduling the harvest

Description	Management zone	Species group	Period (10 year increments)	Priority (1 - 100)
Cutting permit area (category A)	Any	Any	1	1
First entry partial cut stand	Partial cut	F, S, P	Any	3
Spruce, cedar (northern LUs)	G1-12, G29	S predominate S mixed, C	3	4
Fir, pine (southern LUs)	Not G1-G12, G29	F, P	3	4
Other	Any	Any	Any	5
Final entry partial cut stand	Partial cut		Any	2

A.4 Forest Management Assumptions

A.4.6 Silvicultural systems

Partial cutting is prescribed for stands susceptible to beetle infestation. Volume loss caused by a beetle infestation may be prevented or reduced if a stand is partially cut according to a 'beetle proofing' regime. To 'beetle proof' a stand 50% of its volume is harvested upon first entry. Twenty years or more after the first entry the remaining volume is harvested, creating a clearcut. The average age of any regeneration at the time of final harvest is projected to be five years and the regenerated stand is expected to be managed using the clearcutting method. Table A-20. shows the criteria used to define the partial cutting zone and the parameters used to model the partial cutting regime.

Table A-20. Silvicultural systems

Partial cutting zone					Partial cutting regime		
Landscape unit	Biogeoclimatic unit	% clearcut	% partial cut	Number of entries	% retention	Time between entries (years)	Age of regeneration at final entry
G20, G21, G23, G25, G26, G27, G28	ICH mk1	50	50	1	50	20	5
G20, G21, G23, G25, G26, G27, G28	MS dk	29	71	1	50	20	5

Data source and comments:

The per cent breakdown for clearcut and partial cut was based on information from ISIS. The amount of partial cutting was determined by landscape unit and BEC zone. An area-weighted average was determined and applied to each BEC zone to determine the final per cent. The per cent retention, number of entries and time between entries is based on the silviculture prescriptions for the areas to be partially cut.

A.4 Forest Management Assumptions

A.4.7 Unsalvaged losses

Unsalvaged losses account for average annual volume lost to insect and disease epidemics, fire, wind or other damage agents on the timber harvesting land base. Unsalvaged losses reflect only those areas where the volume is not anticipated to be recovered or salvaged.

Table A-21. Unsalvaged losses

Cause of loss	Annual unsalvaged loss (hectares)	Average volume per hectare	Annual unsalvaged loss (m ³ /year)
Wildfire	19.0 ^a	268	5 102
Broadcast/fringe burn	2.0	300	600
Total fire	21.0	271	5 702
Spruce bark beetle	0.0	0	0
Douglas-fir bark beetle	1.0	350	350
Mountain pine bark beetle	3.0	350	1 050
Total insects	4.0	350	1 400
Windthrow/blowdown	1.5	350	525
Avalanche	0.0	0	0
Total loss	29.5	288	7 627

(a) See Table A-22.

A.4 Forest Management Assumptions

Table A-22. *Unsalvaged losses from wildfires*

Landscape unit	Analysis unit number	Area burned from wildfires between 1995-2001 (ha)	Net volume loss (m ³)
G7	41	89	26 700
G29	33	5	2 213
G21	52	20	5 500
G15	43	18	1 300
Loss between 1995 and 2001		132	35 713
Average loss per year		19	5 102

All unsalvaged losses indicated are only those from the 2002 operable land base that burned between 1995 and 2001. Except for wildfire losses and losses due to fringe damage from prescribed burning, unsalvaged losses were based on information collected for the last TSR. The results were slightly adjusted to address changes in trends since the last TSR. The information used in the last TSR was collected from the Golden Forest District staff, licensee annual reports, MLSIS/ISIS (silviculture databases), and Forest Insect Disease Survey (FIDS) reports. The best data available was used for the analysis, which in some cases consisted of professional judgment. Data was pooled from different sources, often in different units and brought together to form a unified product. Generally the information is based on a 6 year average.

Fringe damage losses are based on information supplied by the licensees. Wildfire losses are based on the protection fire reporting system and the professional judgment of district staff.

Note the results are 40% less than that of TSR 2. This is primarily due to reductions in wildfire and fringe burn losses.

A.4 Forest Management Assumptions

A.4.8 Regeneration assumptions in managed stands

Growth of recent plantations and future stands was projected with managed stand yield tables (MSYTs) produced using the Forest Service TIPSy growth and yield model. The table below contains the inputs required to produce MSYTs for this analysis.

Table A-23. Regeneration assumptions by analysis unit

Species group code ^a	Yield table number	Avg SI (m @ 50 yrs)	Regeneration		Regen delay	OAFs		Regeneration species ^a composition	Initial density
			Method	%		1	2		
F (dry)	211	23.7	Planted	100	2	15	5	Fdi ₄₀ Pli ₄₀ Se ₂₀	2000
	212	18.5	Planted	100	2	15	5	Fdi ₄₀ Pli ₄₀ Se ₂₀	2000
	213	15.3	Planted	100	2	15	5	Pl ₈₀ Fdi ₂₀	2000
F (wet)	221	23.4	Planted	100	2	15	5	Fdi ₅₀ Se ₅₀	2000
	222	18.6	Planted	100	2	15	5	Fdi ₅₀ Se ₅₀	2000
	223	15.5	Planted	100	2	15	5	Fdi ₆₀ Pli ₄₀	2000
C	231	19.2	Planted	100	2	15	5	Se ₅₀ Cw ₃₀ Hw ₂₀	2000
	232	15.8	Planted	100	2	15	5	Se ₅₀ Cw ₃₀ Hw ₂₀	2000
	233	12.6	Planted	100	2	15	5	Se ₇₀ Fdi ₂₀ Cw ₁₀	2000
H	241	18.7	Planted	100	2	15	5	Se ₆₀ Hw ₂₀ Cw ₂₀	2000
	242	15.2	Planted	100	2	15	5	Se ₆₀ Hw ₂₀ Cw ₂₀	2000
	243	12.1	Planted	100	2	15	5	Se ₇₀ Fdi ₂₀ Pli ₁₀	2000
B, S	251	20.8	Planted	100	2	15	5	Se ₇₀ Pli ₂₀ Bl ₁₀	2000
S pre-dominant	252	15.1	Planted	100	2	15	5	Se ₇₀ Pli ₂₀ Bl ₁₀	2000
	253	10.8	Planted	100	2	15	5	Se ₈₀ Pli ₂₀	2000
S (mixed)	261	23.7	Planted	100	2	15	5	Se ₇₀ Fdi ₂₀ Pli ₁₀	2000
	262	18.7	Planted	100	2	15	5	Se ₇₀ Fdi ₂₀ Pli ₁₀	2000
	263	15.1	Planted	100	2	15	5	Se ₇₀ Pli ₂₀ Fdi ₁₀	2000
	264	11.2	Planted	100	2	15	5	Se ₇₀ Fdi ₂₀ Pli ₁₀	2000

(continued)

(a) Codes taken from the Vegetation Resources Inventory B.C. Land Cover Classification Scheme Document.

(b) Existing deciduous leading stands age 25 or less — coniferous understory component.

(c) Existing deciduous leading stands age 25 or less — future regeneration assumptions (conversion to coniferous stand).

A.4 Forest Management Assumptions

Table A-23. Regeneration assumptions by analysis unit (concluded)

Species group code ^a	Yield table number	Avg SI (m @ 50 yrs)	Regeneration		Regen delay	OAFs		Regeneration species ^a composition	Initial density
			Method	%		1	2		
P	271	22.6	Planted	100	2	15	5	Pli ₆₀ Se ₂₀ Fdi ₂₀	2000
	272	19.9	Planted	100	2	15	5	Pli ₆₀ Se ₂₀ Fdi ₂₀	2000
	274	16.6	Planted	100	2	15	5	Pli ₆₀ Se ₂₀ Fdi ₂₀	2000
	273	14.6	Planted	100	2	15	5	Pli ₇₀ Fdi ₂₀ Se ₁₀	2000
Deciduous ^b	181	20.1	Planted	100	N/A	25	5	Ac ₅₀ Se ₃₅ Pli ₁₀ Fdi ₅	2000
	182	13.9	Planted	100	N/A	25	5	Ac ₅₀ Se ₃₅ Pli ₁₀ Fdi ₅	2000
	183	10.8	Planted	100	N/A	25	5	Ac ₅₀ Se ₃₅ Pli ₁₀ Fdi ₅	2000
Deciduous ^c	281	20.1	Planted	100	2	15	5	Se ₇₀ Pli ₂₀ Fdi ₁₀	2000
	282	13.9	Planted	100	2	15	5	Se ₇₀ Pli ₂₀ Fdi ₁₀	2000
	283	10.8	Planted	100	2	15	5	Se ₇₀ Pli ₂₀ Fdi ₁₀	2000

(a) Codes taken from the Vegetation Resources Inventory B.C. Land Cover Classification Scheme Document.

(b) Existing deciduous leading stands age 25 or less — coniferous understory component.

(c) Existing deciduous leading stands age 25 or less — future regeneration assumptions (conversion to coniferous stand).

A.4 Forest Management Assumptions

Genetic gain is the percentage increase in certain traits (e.g., stem volume, relative wood density or pest resistance) of trees grown from select seed, over those grown from wild stand seed. The genetic gain of a seedlot is expressed as its genetic worth (GW). The GW for stem volume is the percentage gain in volume expected for a seedlot at or near harvest age. The demand for genetically improved seed is greater than the supply. The base case reflects the genetic worth of the TSA's current allocation of orchard seed. Spruce is the only orchard seed being used. Weighted "blended" genetic gain is the gain associated with Golden TSA's allocation of improved seed (based on an estimated ratio of orchard and wild stand stock, and predicted orchard production). The "PI high genetic gain" represents a further increase in genetic gain expectations by assuming that orchards would be developed for high elevation lodgepole pine in twenty years time.

Table A-24. Genetic worth

Seed production unit	Current genetic gain (%)	Weighted "blended" genetic gain (20 years) (%)	Weighted "full gain" genetic gain (20 years) (%)	Weighted "PI high" genetic gain (20 years) (%)
Fdi - All	0.00	5.73	14.74	14.74
Pli - All	0.00	3.13	5.57	9.93
Sx - All	14.00	14.07	21.13	21.13

Data source and comments:

This table is based on Table 4.5 Genetic Gain Scenarios — found in *Timber Supply Impacts of the Current and Planned Seed Orchard Program in the Golden Timber Supply Area*, November 26, 2001.

Note the "weighted" genetic gain was calculated by taking the weighted average of the "Modelled Annual Seedling Demand" and the associated "genetic gain" for each SPU, by species.

Note: Lw and Pw were not included in the analysis as they are planted in very low numbers (considered insignificant).

A.4 Forest Management Assumptions

A.4.9 Immature plantation history

This section identifies areas of existing immature forest where the density (stems per hectare) has been controlled and was assigned to a managed stand yield table (MSYT).

Table A-25. Immature plantation history

Analysis unit	Area managed (%)		
	Age 1 – 10	Age 11 – 20	Age 21 - 25
All	100	100	100

A.4.10 Not satisfactorily restocked (NSR) areas

The purpose of this section is to identify the total area of NSR currently existing in the timber harvesting land base, and the estimated rate at which the NSR area will be restocked.

Table A-26. Not satisfactorily restocked (NSR) areas

Analysis unit	Current NSR (hectares)	Backlog NSR ≥ 60% MSS ^a	Backlog NSR < 60% MSS
All	1689	3445	318

(a) MSS = minimum stocking standard.

Table A-27. Regeneration assumptions for backlog NSR analysis units

Analysis unit	Yield table number	Regeneration		Regen delay	Volume adjustment factor	Species ^a composition	Crown closure
		Method	%				
Backlog 1	105	Natural	100	12	0.90	S ₄₀ Pli ₂₂ Fdi ₂₂ C ₉ H ₇	46
Backlog 2	106	Natural	100	20	0.75	S ₄₀ Pli ₂₂ Fdi ₂₂ C ₉ H ₇	46

(a) Letter codes taken from the Vegetation Resources Inventory B.C. Land Cover Classification Scheme.

Data source and comments:

Not satisfactorily restocked areas for past harvest were determined using ISIS. NSR areas for burns prior to and including 1996 have been reclassified in the new VRI. Approximately 132 hectares of wildfires that occurred in the operable land base since 1996 that were not salvage harvested are considered NSR and have been put into the current NSR category. Current NSR is modelled with a regeneration delay according to standard practice (Table A-23).

A.4 Forest Management Assumptions

A.4.11 Forest cover requirements

Forest cover requirements may be examined at a number of different levels, including landscape units, wildlife areas and visual quality areas. With the requirement to retain different forest characteristics across the landscape, it is important to identify how non-contributing forest (productive forest which does not contribute to the timber harvesting land base) may be considered in the forest cover requirements (i.e.; maximum allowable disturbance or minimum area retention).

The following tables describe the forest cover requirements to be applied.

A.4 Forest Management Assumptions

Table A-28. Forest cover requirements for landscape biodiversity

Biogeoclimatic unit(s)	NDT	Biodiversity option	Mature + old-seral stage ^a		Old-seral stage			Minimum age (years)
			Minimum retention area (%)	Minimum age (years)	Maximum retention area (%)			
					Now	66 years	136 years	
ESSF vc, wc2, wc4, wm	1	Low	19	120	6.3	12.7	19.0	250
		Intermediate	36	120	19.0	19.0	19.0	250
		High	54	120	28.0	28.0	28.0	250
ESSF mm1	2	Low	14	120	3.0	6.0	9.0	250
		Intermediate	28	120	9.0	9.0	9.0	250
		High	42	120	13.0	13.0	13.0	250
ESSF dk	3	Low	14	120	4.7	9.3	14.0	140
		Intermediate	23	120	14.0	14.0	14.0	140
		High	34	120	21.0	21.0	21.0	140
ICH vk1, wk1	1	Low	17	100	4.3	8.7	13.0	250
		Intermediate	34	100	13.0	13.0	13.0	250
		High	51	100	19.0	19.0	19.0	250
ICH mw1	2	Low	15	100	3.0	6.0	9.0	250
		Intermediate	31	100	9.0	9.0	9.0	250
		High	46	100	13.0	13.0	13.0	250
ICH mk1	3	Low	14	100	4.7	9.3	14.0	140
		Intermediate	23	100	14.0	14.0	14.0	140
		High	34	100	21.0	21.0	21.0	140
MS dk	3	Low	14	100	4.7	9.3	14.0	140
		Intermediate	26	100	14.0	14.0	14.0	140
		High	39	100	21.0	21.0	21.0	140
IDF dm2	4	Low	17	100	4.3	8.7	13.0	250
		Intermediate	34	100	13.0	13.0	13.0	250
		High	51	100	19.0	19.0	19.0	250

(a) Note the mature + old seral stage targets were only applied to those landscape units and biogeoclimatic units specified in the higher level plan.

A.4 Forest Management Assumptions

The Higher Level Plan (October 2002) requires that mature plus old forests be managed in the following landscape units and biogeoclimatic subzone/variants.

Table A-29. Forest cover requirements for mature plus old forests

Landscape unit	Biogeoclimatic subzone/variant
G1	ESSFwc2, ICH wk1
G6	ESSFwc2, ICH mw1, ICH vk1
G12	ESSFvc, ESSFwc2, ICH wk1
G13	ESSFvc, ESSFwc2, ESSFwm, ICH mw1, ICH wk1
G24	ESSFwm, ICH mw1
G26	MS dk
G27	ESSFdk, MS dk

Table 30 shows the assignment of high (H), intermediate (I) and low (L) biodiversity emphasis options (BEO) for Golden analysis area. Landscape units G21, G22, G26 and G28 have more than one BEO identified in the *KBHLPO*. In these landscape units BEO area is identified using variant taken from the latest version of the biogeoclimatic (BEC) map. This varies with the *KBHLPO* which used variants from a 1999 version of the BEC map.

Table A-30. Assignment of biodiversity emphasis options for Golden analysis area

BEO	Landscape units	BEC variants
H	G1, G6, G12, G13, G24, G27	Any
H	G26	MS dk
I	G2, G4, G11, G16, G20, G23, G29	Any
I	G21	ICHmw1; ESSF wm, wmp
I	G22	ICH mw1, wk1
I	G28	MS dk
L	G3, G7, G8, G9, G10, G14, G15, G17, G18, G19, G25, G38	Any
L	G21	Not (ICH mw1; ESSF wm, wmp)
L	G22	Not (ICHmw1, wk1) – mostly ESSFwm
L	G26, G28	Not MS dk

A.4 Forest Management Assumptions

When modelling seral requirements for biodiversity it is assumed that all stands in the non-contributing forest will age according to an average natural return cycle. Based on seven years of fire history it was determined that about 370 hectares per year above the operability line is lost to wildfires.

Objective 5 of the KBHLPO requires any old plus mature forest beyond the targeted amount identified in *Objective 2* of the KBHLPO be allocated to connectivity corridors — according to the procedure set out in *Objective 5*. There is no provision in the FSSIM forest estate model to address this requirement. However, a sensitivity test indicated that the timber supply impact of *Objective 5* was negligible relative to the base case.

A.4 Forest Management Assumptions

Table A-31. Forest cover requirements

Zone or group	Green-up height	Green-up maximum allowable disturbance %	Older age (years)	Minimum area of older age retained %	Land base constraints apply to
Caribou ESSF above caribou line	2.5	25	140	70	Crown forested area below 80% slopes
Caribou ESSF below caribou line ^a	2.5	25	140	40	Crown forested area below
			250	10	80% slopes
Caribou ICH above caribou line	2.5	25	140	70	Crown forested area below 80% slopes
Caribou ICH below caribou line	2.5	25	140	40	Crown forested area below
			250	10	80% slopes
Ungulate winter range ^b	2.5	25	100	40	Crown forested
Domestic watershed ^c	6.0	25	N/A	N/A	Crown forested
IRM zone	2.5	25	N/A	N/A	Timber harvesting
Visual quality preservation ^d	6.0	1	N/A	N/A	Visual landscape unit-crown forested
Visual quality retention ^d	6.0	5	N/A	N/A	Visual landscape unit-crown forested
Visual quality partial retention ^d	6.0	15	N/A	N/A	Visual landscape unit-crown forested

(a) Forest cover requirements in *Objective 3* of the KBHLPO for the ESSF below the caribou line indicates that 30% of the forested area must be maintained in age class 8 or older, and at least one-third of this 30% must be in age class 9. On an additional 20% (minimum) of the area employ partial cutting prescriptions which maintain suitable caribou habitat attributes. Because data of sufficient detail and accuracy is not available to model partial cutting prescriptions using FSSIM a 40% forest cover target was used for stands greater than 140 years of age for this zone.

(b) An ungulate winter range forest constraint was also be applied to the Columbia wildlife management area.

(c) The data is not available to model domestic watersheds as described in *Objective 6* of the KBHLPO so the forest cover constraints similar to those of TSR 2 are being used.

(d) Visual landscape units and associated visual management objectives reflect *Objective 9* of the KBHLPO.

A.4 Forest Management Assumptions

A.4.12 Reductions to reflect volume retention in cutblocks

Riparian management zones (RMZ)

Section A.3.10 describes how retention of trees in riparian management zones is accounted for in the analysis.

Wildlife trees (WT) and tree patches (WTP)

Stand structure for stand-level biodiversity can be maintained in wildlife trees or wildlife tree patches.

Table A-32. Reductions to reflect volume retention in cutblocks

Biogeoclimatic unit	Wildlife tree retention required (% of cutblock area)
ESSFdk	5.5
ESSFmm1	6.6
ESSFvc	5.8
ESSFwc2	7.4
ESSFwm	7.3
ICH mk1	5.2
ICH mw1	6.4
ICH vk1	5.7
ICH wk1	5.9
IDF dm2	3.2
MS dk	5.9

Data source and comments:

Wildlife tree requirements were determined based on Table A3.1 of the *Landscape Unit Planning Guide*. (When landscape units have been designated and landscape level biodiversity objectives have been established). The retention percentages are based on the assumption that 50% of the wildlife tree requirements will be met from the non contributing forested areas. It was assumed that all clearcut harvesting prior to 1996 (obtained from the ISIS database) was harvested without wildlife tree patches and all areas harvested in 1996 and beyond were harvested with wildlife tree patches. Wildlife tree requirements were calculated for each landscape unit/subzone. The results were area weighted for each BEC subzone.

Most wildlife trees are left in patches adjacent to cutblocks. They are expected to persist over at least 2 rotations. Many of these patches are greater than 2 hectares in size and can contribute to old-seral stage forest requirements at the landscape level.

A.5 Volume Estimates for Existing Stands

The variable density yield projection (VDYP) model, version 6.6d developed and supported by the Ministry of Sustainable Resource Management, Terrestrial Information Branch, was used to estimate timber volumes for existing natural stands. Table A-33 shows the volume estimates by analysis unit for existing natural stands

Table A-33. Timber volume tables for existing natural stands (cubic metres/hectare)

Age (years)	Analysis units ^a (fir dry, fir wet and cedar-existing natural stands)								
	111	112	113	121	122	123	131	132	133
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
30	20.3	0.1	0.0	28.3	1.7	0.0	0.9	0.0	0.0
40	67.9	26.3	3.4	89.5	42.6	8.4	47.5	25.4	0.0
50	116.5	61.8	31.7	149.2	89.0	47.0	92.8	72.4	29.4
60	163.8	96.9	60.0	205.8	133.4	83.7	134.9	115.5	63.9
70	208.7	131.1	87.8	258.9	175.2	118.1	172.4	153.9	94.7
80	250.6	163.8	114.4	307.9	214.3	150.3	206.5	189.1	122.9
90	290.1	195.1	140.1	352.7	250.3	179.8	231.9	215.4	145.0
100	322.7	224.7	164.6	393.6	283.7	207.0	252.9	236.8	163.4
110	350.1	252.7	187.9	425.9	314.6	232.2	270.5	254.4	178.8
120	374.9	277.3	208.4	453.9	341.4	254.0	284.6	268.1	191.3
130	397.8	298.0	227.4	480.9	367.2	275.0	305.1	289.2	208.3
140	416.6	315.3	243.8	505.0	389.3	294.0	325.0	309.6	224.6
150	433.3	330.5	258.3	527.1	408.4	311.0	343.7	328.7	239.9
160	448.2	344.1	270.7	546.9	425.6	326.0	360.5	346.6	254.1
170	461.5	356.3	281.2	565.1	441.4	339.2	375.9	363.2	267.3
180	473.2	367.3	291.6	581.7	456.0	352.5	390.6	379.2	280.0
190	483.4	377.0	301.1	597.0	469.5	365.0	404.5	394.3	292.1
200	493.9	386.9	310.9	611.8	482.5	377.2	418.3	409.2	303.9
210	503.8	396.3	320.4	625.8	494.9	389.1	431.4	423.6	315.3
220	513.2	405.1	329.5	639.1	506.6	400.4	446.6	440.3	328.4
230	522.2	413.6	336.9	651.7	517.7	411.4	461.5	456.8	341.5
240	530.6	421.6	343.9	663.7	528.3	421.9	476.3	473.1	354.4
250	538.6	429.3	350.6	675.1	538.5	432.1	490.3	489.1	367.0
260	538.2	429.5	350.9	676.1	539.7	433.9	491.2	491.6	369.5
270	537.9	429.6	351.1	676.9	540.7	435.6	492.0	493.5	371.9
280	537.5	429.8	351.3	677.7	541.7	437.1	492.7	495.2	374.2
290	537.1	429.9	351.4	678.4	542.6	438.5	493.3	496.8	376.4
300	536.7	429.9	351.4	679.0	543.5	439.9	493.8	498.3	378.5
310	535.9	430.0	351.4	679.6	544.2	441.1	494.2	499.7	380.5
320	534.8	430.0	351.4	680.1	544.9	442.2	494.6	501.1	382.0
330	533.7	429.7	351.2	680.6	545.6	443.2	494.9	502.4	383.4
340	532.6	429.3	351.1	681.0	546.2	444.1	495.2	503.6	384.8
350	531.3	428.8	350.9	681.4	546.7	445.0	495.4	504.7	386.1

(continued)

(a) Analysis unit legend:

1st digit = stand status (existing natural=1, managed=2, road right-of-way=8, not Crown forest=9);

2nd digit = species group (fir dry=1, fir wet=2, cedar=3, hemlock=4, spruce predominant=5, spruce mixed=6, pine=7, deciduous=8, not grouped by species (non-forest, non-contributing forest or backlog)=0);

3rd digit = productivity rating (upper range (good)=1, mid range (medium)=2, lower mid range (medium) or lower range (poor)=3, lower range (poor)=4, backlog 1=5, backlog 2=6, not rated=0).

A.5 Volume Estimates for Existing Stands

Table A-33. Timber volume tables for existing natural stands (cubic metres/hectare)

Analysis units ^a (hemlock, spruce predominant and spruce mixed—existing natural stands)									
Age (years)	141	142	143	151	152	153	161	162	163
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	2.2	0.0	0.0	0.3	0.0	0.0	0.4	0.0	0.0
40	65.2	2.1	0.0	23.7	1.5	0.0	54.9	4.2	0.0
50	139.2	46.5	1.4	89.4	14.0	0.9	126.3	35.8	10.0
60	205.6	99.9	29.1	147.3	59.7	7.6	190.6	125.7	61.1
70	264.3	148.0	72.3	197.2	100.7	29.4	246.6	179.7	109.1
80	315.9	191.0	112.2	239.6	137.4	62.3	294.3	227.3	153.1
90	354.1	223.6	145.0	274.7	168.9	91.6	334.5	268.4	192.2
100	384.5	249.7	172.5	303.9	196.1	117.9	368.0	304.0	226.9
110	408.9	270.6	195.3	328.3	219.7	141.6	395.9	334.6	257.7
120	427.5	286.7	213.8	348.6	239.9	162.7	418.5	360.7	284.5
130	452.5	308.4	236.2	367.7	259.5	183.3	438.4	385.0	310.0
140	474.8	327.9	256.5	384.2	277.0	202.2	455.2	404.6	331.9
150	494.8	345.4	274.9	398.4	292.6	219.5	469.6	421.3	351.0
160	512.4	361.0	291.5	410.7	306.3	235.4	481.3	435.4	367.5
170	527.7	374.7	306.3	421.3	318.5	249.9	491.2	447.5	381.9
180	541.3	387.1	319.9	430.8	329.6	263.2	499.5	457.8	394.9
190	553.2	398.0	331.9	439.1	339.6	275.4	506.5	466.4	406.4
200	565.4	409.3	344.1	446.6	348.8	286.7	513.5	474.9	417.4
210	576.9	420.0	355.7	453.4	357.1	297.1	519.9	482.6	427.3
220	586.7	430.2	366.8	459.6	364.8	306.8	525.8	489.6	436.4
230	595.7	440.1	377.4	465.1	371.9	315.7	531.2	496.0	444.7
240	604.0	448.7	387.5	470.1	378.4	324.0	536.3	501.8	452.5
250	611.7	456.4	397.3	474.6	384.4	331.7	540.9	507.1	459.7
260	614.3	460.0	402.8	477.0	387.4	336.0	543.2	510.7	464.0
270	616.6	463.4	408.1	479.1	390.0	340.0	545.2	513.9	467.9
280	618.6	466.5	411.9	480.9	392.4	343.7	546.8	516.9	471.5
290	620.4	469.4	415.4	482.5	394.2	347.1	548.1	519.6	474.7
300	621.9	472.2	418.7	483.9	395.8	350.2	549.2	522.1	477.7
310	623.3	474.7	421.8	485.1	397.2	353.2	550.2	524.3	480.4
320	624.5	477.1	424.7	486.2	398.5	355.9	551.1	526.0	482.7
330	625.6	479.3	427.5	487.1	399.6	358.3	551.8	527.6	484.6
340	626.5	481.4	430.1	487.8	400.5	360.6	552.4	529.0	486.3
350	627.3	483.4	432.6	488.4	401.4	362.7	552.9	530.3	487.8

(continued)

(a) Analysis unit legend:

1st digit = stand status (existing natural=1, managed=2, road right-of-way=8, not Crown forest=9);

2nd digit = species group (fir dry=1, fir wet=2, cedar=3, hemlock=4, spruce predominant=5, spruce mixed=6, pine=7, deciduous=8, not grouped by species (non-forest, non-contributing forest or backlog)=0);

3rd digit = productivity rating (upper range (good)=1, mid range (medium)=2, lower mid range (medium) or lower range (poor)=3, lower range (poor)=4, backlog 1=5, backlog 2=6, not rated=0).

A.5 Volume Estimates for Existing Stands

Table A-33. Timber volume tables for existing natural stands (cubic metres/hectare)

Age (years)	Analysis units ^a (spruce mixed, pine and deciduous — existing natural stands)							
	164	171	172	173	174	181	182	183
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	52.3	30.1	4.3	0.0	8.3	0.0	0.0
40	0.0	117.6	87.1	49.9	22.7	46.6	3.6	0.0
50	0.6	173.7	137.4	91.4	64.0	78.2	24.6	2.6
60	6.1	221.9	181.6	128.3	101.3	104.3	49.8	23.1
70	43.6	263.6	220.3	161.0	135.0	126.2	71.4	42.3
80	86.9	299.8	254.4	190.2	165.5	144.5	90.7	60.5
90	125.8	331.9	285.0	216.7	193.4	160.0	108.0	77.5
100	160.8	360.6	312.6	240.7	219.0	173.3	123.5	93.4
110	192.2	386.4	337.7	262.8	242.7	184.7	137.4	108.1
120	219.8	410.0	360.8	283.2	264.6	194.6	149.9	121.6
130	246.9	431.7	382.3	302.2	285.3	203.5	161.3	134.3
140	271.3	446.2	396.7	315.3	299.7	211.0	171.2	145.6
150	293.2	457.5	408.0	325.7	311.2	217.4	180.1	155.9
160	312.9	465.4	416.1	333.2	319.8	219.9	183.8	160.5
170	330.5	470.2	421.1	338.1	325.6	221.8	187.0	164.6
180	346.5	472.0	423.1	340.3	328.5	223.4	189.7	168.2
190	361.0	470.7	422.1	340.0	328.7	224.5	191.9	171.3
200	374.6	473.3	424.8	342.7	331.9	225.8	194.2	174.4
210	387.3	476.2	427.7	345.6	335.2	227.0	196.3	177.3
220	399.2	479.2	430.7	348.6	338.5	228.1	198.2	180.0
230	410.2	482.2	433.7	351.5	341.7	229.1	200.0	182.5
240	420.5	485.1	436.5	354.2	344.7	230.0	201.7	184.9
250	430.2	487.9	439.3	356.9	347.5	230.8	203.2	187.1
260	436.0	490.1	441.3	358.9	349.8	231.4	204.4	188.8
270	441.3	492.1	443.2	360.8	351.9	232.0	205.5	190.5
280	446.1	494.0	444.9	362.5	353.8	232.4	206.5	192.0
290	450.2	495.7	446.6	364.1	355.5	232.9	207.4	193.5
300	453.9	497.4	448.1	365.6	357.1	233.2	208.3	194.8
310	457.3	498.9	449.4	366.9	358.5	233.6	209.1	196.0
320	460.3	500.3	450.6	368.1	359.7	233.9	209.8	197.1
330	463.0	501.6	451.7	369.2	360.8	234.1	210.4	198.2
340	465.4	502.8	452.7	370.1	361.7	234.3	211.0	199.2
350	467.7	503.8	453.6	370.9	362.5	234.5	211.5	200.1

(continued)

(a) Analysis unit legend:

1st digit = stand status (existing natural=1, managed=2, road right-of-way=8, not Crown forest=9);

2nd digit = species group (fir dry=1, fir wet=2, cedar=3, hemlock=4, spruce predominant=5, spruce mixed=6, pine=7, deciduous=8, not grouped by species (non-forest, non-contributing forest or backlog)=0);

3rd digit = productivity rating (upper range (good)=1, mid range (medium)=2, lower mid range (medium) or lower range (poor)=3, lower range (poor)=4, backlog 1=5, backlog 2=6, not rated=0).

A.5 Volume Estimates for Existing Stands

Table A-33. Timber volume tables for existing natural stands (cubic metres/hectare) (concluded)

Age (years)	Analysis units ^a (backlog, non-contributing forest, road R-O-W, not Crown forest)				
	105	106	100	800	900
10	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.7	0.0	0.0
50	17.7	14.7	32.7	0.0	0.0
60	63.9	53.2	79.9	0.0	0.0
70	107.6	89.7	124.5	0.0	0.0
80	148.4	123.7	165.3	0.0	0.0
90	185.2	154.3	201.5	0.0	0.0
100	218.5	182.1	233.5	0.0	0.0
110	248.8	207.3	262.0	0.0	0.0
120	275.5	229.6	286.7	0.0	0.0
130	301.5	251.3	310.1	0.0	0.0
140	322.4	268.7	329.2	0.0	0.0
150	340.6	283.8	345.9	0.0	0.0
160	356.3	296.9	359.6	0.0	0.0
170	369.6	308.0	371.2	0.0	0.0
180	381.6	318.0	381.5	0.0	0.0
190	391.9	326.6	389.8	0.0	0.0
200	402.2	335.2	398.4	0.0	0.0
210	411.6	343.0	406.4	0.0	0.0
220	420.3	350.2	413.9	0.0	0.0
230	428.3	356.9	421.0	0.0	0.0
240	435.7	363.1	427.6	0.0	0.0
250	442.7	368.9	433.7	0.0	0.0
260	445.8	371.5	436.5	0.0	0.0
270	448.6	373.9	439.0	0.0	0.0
280	451.2	376.0	441.4	0.0	0.0
290	453.6	378.0	443.3	0.0	0.0
300	455.8	379.8	445.0	0.0	0.0
310	457.7	381.4	446.5	0.0	0.0
320	459.5	382.9	447.9	0.0	0.0
330	461.1	384.3	449.2	0.0	0.0
340	462.6	385.5	450.3	0.0	0.0
350	463.9	386.6	451.3	0.0	0.0

(a) Analysis unit legend:

1st digit = stand status (existing natural=1, managed=2, road right-of-way=8, not Crown forest=9);

2nd digit = species group (fir dry=1, fir wet=2, cedar=3, hemlock=4, spruce predominant=5, spruce mixed=6, pine=7, deciduous=8, not grouped by species (non-forest, non-contributing forest or backlog)=0);

3rd digit = productivity rating (upper range (good)=1, mid range (medium)=2, lower mid range (medium) or lower range (poor)=3, lower range (poor)=4, backlog 1=5, backlog 2=6, not rated=0).

A.6 Volume Estimates for Regenerated Stands

Table A-34. Projected volumes for managed stands using TIPSy (cubic metres/hectare)

Age (years)	Analysis units ^a (fir dry, fir wet and cedar—managed stands)								
	211	212	213	221	222	223	231	232	233
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	65.0	5.0	10.0	31.0	0.0	0.0	1.0	0.0	0.0
40	165.0	46.0	43.0	129.0	24.0	8.0	48.0	5.0	0.0
50	264.0	107.0	94.0	244.0	87.0	33.0	144.0	50.0	4.0
60	343.0	172.0	140.0	327.0	160.0	67.0	238.0	121.0	29.0
70	400.0	233.0	180.0	393.0	233.0	108.0	325.0	190.0	74.0
80	448.0	277.0	211.0	442.0	291.0	146.0	388.0	255.0	124.0
90	448.0	316.0	239.0	477.0	332.0	181.0	443.0	317.0	170.0
100	448.0	349.0	262.0	504.0	369.0	209.0	489.0	363.0	213.0
110	448.0	376.0	282.0	530.0	397.0	234.0	528.0	398.0	257.0
120	448.0	402.0	298.0	551.0	425.0	257.0	559.0	429.0	292.0
130	448.0	419.0	311.0	551.0	445.0	277.0	586.0	455.0	323.0
140	448.0	439.0	322.0	551.0	461.0	293.0	604.0	481.0	344.0
150	448.0	450.0	331.0	551.0	473.0	309.0	623.0	502.0	363.0
160	448.0	460.0	340.0	551.0	483.0	323.0	642.0	519.0	375.0
170	448.0	468.0	347.0	551.0	493.0	337.0	661.0	534.0	388.0
180	448.0	477.0	355.0	551.0	502.0	348.0	675.0	545.0	399.0
190	448.0	484.0	360.0	551.0	511.0	360.0	686.0	555.0	409.0
200	448.0	490.0	365.0	551.0	516.0	369.0	697.0	561.0	418.0
210	448.0	494.0	370.0	551.0	521.0	378.0	704.0	568.0	422.0
220	448.0	499.0	375.0	551.0	524.0	385.0	717.0	579.0	429.0
230	448.0	499.0	377.0	551.0	526.0	391.0	726.0	582.0	433.0
240	448.0	499.0	381.0	551.0	529.0	395.0	736.0	590.0	438.0
250	448.0	499.0	380.0	551.0	533.0	398.0	736.0	594.0	443.0
260	448.0	499.0	381.0	551.0	534.0	402.0	736.0	603.0	444.0
270	448.0	499.0	379.0	551.0	534.0	407.0	736.0	611.0	444.0
280	448.0	499.0	379.0	551.0	534.0	411.0	736.0	616.0	446.0
290	448.0	499.0	378.0	551.0	534.0	413.0	736.0	621.0	446.0
300	448.0	499.0	378.0	551.0	534.0	413.0	736.0	621.0	446.0
310	448.0	499.0	378.0	551.0	534.0	413.0	736.0	621.0	446.0
320	448.0	499.0	378.0	551.0	534.0	413.0	736.0	621.0	446.0
330	448.0	499.0	378.0	551.0	534.0	413.0	736.0	621.0	446.0
340	448.0	499.0	378.0	551.0	534.0	413.0	736.0	621.0	446.0
350	448.0	499.0	378.0	551.0	534.0	413.0	736.0	621.0	446.0

(continued)

(a) Analysis unit legend:

1st digit = stand status (existing natural=1, managed=2, road right-of-way=8, not Crown forest=9);

2nd digit = species group (fir dry=1, fir wet=2, cedar=3, hemlock=4, spruce predominant=5, spruce mixed=6, pine=7, deciduous=8, not grouped by species (non-forest, non-contributing forest or backlog)=0);

3rd digit = productivity rating (upper range (good)=1, mid range (medium)=2, lower mid range (medium) or lower range (poor)=3, lower range (poor)=4, backlog 1=5, backlog 2=6, not rated=0).

A.6 Volume Estimates for Regenerated Stands

Table A-34. Projected volumes for managed stands using TIPSy (cubic metres/hectare)

Age (years)	Analysis units ^a (hemlock, spruce pred. and spruce mixed — managed stands)								
	241	242	243	251	252	253	261	262	263
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
30	1.0	0.0	0.0	14.0	0.0	0.0	34.0	2.0	0.0
40	41.0	2.0	0.0	93.0	5.0	0.0	143.0	39.0	5.0
50	130.0	39.0	3.0	198.0	44.0	2.0	256.0	118.0	44.0
60	220.0	102.0	25.0	291.0	104.0	11.0	351.0	196.0	102.0
70	306.0	173.0	63.0	368.0	170.0	39.0	411.0	275.0	166.0
80	374.0	232.0	110.0	417.0	225.0	78.0	453.0	335.0	220.0
90	423.0	294.0	155.0	451.0	280.0	122.0	486.0	376.0	273.0
100	464.0	343.0	196.0	476.0	326.0	162.0	486.0	408.0	317.0
110	499.0	379.0	234.0	491.0	360.0	199.0	486.0	433.0	351.0
120	527.0	408.0	272.0	499.0	385.0	232.0	486.0	452.0	374.0
130	552.0	434.0	300.0	502.0	405.0	267.0	486.0	469.0	392.0
140	570.0	457.0	325.0	502.0	421.0	299.0	486.0	478.0	408.0
150	582.0	475.0	342.0	502.0	431.0	321.0	486.0	483.0	421.0
160	595.0	492.0	358.0	502.0	442.0	341.0	486.0	488.0	432.0
170	607.0	504.0	369.0	502.0	449.0	355.0	486.0	493.0	441.0
180	621.0	516.0	382.0	502.0	455.0	369.0	486.0	497.0	446.0
190	630.0	527.0	389.0	502.0	462.0	378.0	486.0	500.0	453.0
200	637.0	531.0	397.0	502.0	463.0	386.0	486.0	501.0	454.0
210	645.0	538.0	403.0	502.0	462.0	393.0	486.0	502.0	454.0
220	649.0	542.0	407.0	502.0	462.0	398.0	486.0	502.0	454.0
230	657.0	546.0	412.0	502.0	461.0	402.0	486.0	502.0	455.0
240	663.0	551.0	415.0	502.0	461.0	409.0	486.0	502.0	453.0
250	668.0	553.0	419.0	502.0	457.0	410.0	486.0	502.0	454.0
260	672.0	557.0	421.0	502.0	457.0	412.0	486.0	502.0	454.0
270	672.0	559.0	423.0	502.0	455.0	413.0	486.0	502.0	451.0
280	672.0	563.0	422.0	502.0	456.0	414.0	486.0	502.0	451.0
290	672.0	567.0	420.0	502.0	454.0	414.0	486.0	502.0	452.0
300	672.0	567.0	420.0	502.0	454.0	414.0	486.0	502.0	452.0
310	672.0	567.0	420.0	502.0	454.0	414.0	486.0	502.0	452.0
320	672.0	567.0	420.0	502.0	454.0	414.0	486.0	502.0	452.0
330	672.0	567.0	420.0	502.0	454.0	414.0	486.0	502.0	452.0
340	672.0	567.0	420.0	502.0	454.0	414.0	486.0	502.0	452.0
350	672.0	567.0	420.0	502.0	454.0	414.0	486.0	502.0	452.0

(continued)

(a) Analysis unit legend:

1st digit = stand status (existing natural=1, managed=2, road right-of-way=8, not Crown forest=9);

2nd digit = species group (fir dry=1, fir wet=2, cedar=3, hemlock=4, spruce predominant=5, spruce mixed=6, pine=7, deciduous=8, not grouped by species (non-forest, non-contributing forest or backlog)=0);

3rd digit = productivity rating (upper range (good)=1, mid range (medium)=2, lower mid range (medium) or lower range (poor)=3, lower range (poor)=4, backlog 1=5, backlog 2=6, not rated=0).

A.6 Volume Estimates for Regenerated Stands

Table A-34. Projected volumes for managed stands using TIPSy (cubic metres/hectare) (concluded)

Age (years)	Analysis units ^a (spruce mixed, pine and deciduous — managed stands)							
	264	271	272	273	274	281	282	283
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	12.0	2.0	0.0	0.0	0.0	0.0	0.0
30	0.0	92.0	46.0	5.0	4.0	9.0	0.0	0.0
40	0.0	191.0	127.0	62.0	26.0	74.0	2.0	0.0
50	1.0	273.0	201.0	122.0	70.0	169.0	21.0	2.0
60	13.0	337.0	262.0	173.0	118.0	256.0	68.0	11.0
70	42.0	385.0	314.0	216.0	160.0	333.0	127.0	36.0
80	80.0	424.0	352.0	251.0	195.0	384.0	179.0	73.0
90	124.0	456.0	383.0	284.0	226.0	420.0	226.0	114.0
100	162.0	475.0	408.0	310.0	256.0	449.0	273.0	154.0
110	199.0	475.0	428.0	329.0	280.0	470.0	311.0	188.0
120	233.0	475.0	448.0	345.0	298.0	486.0	340.0	220.0
130	266.0	475.0	460.0	358.0	314.0	490.0	363.0	253.0
140	293.0	475.0	467.0	371.0	326.0	494.0	379.0	281.0
150	315.0	475.0	475.0	382.0	336.0	500.0	393.0	305.0
160	332.0	475.0	480.0	391.0	346.0	500.0	404.0	323.0
170	344.0	475.0	487.0	401.0	353.0	500.0	414.0	336.0
180	357.0	475.0	487.0	407.0	358.0	500.0	423.0	348.0
190	367.0	475.0	487.0	410.0	365.0	500.0	429.0	358.0
200	377.0	475.0	487.0	415.0	368.0	500.0	434.0	366.0
210	382.0	475.0	487.0	417.0	373.0	500.0	438.0	374.0
220	387.0	475.0	487.0	419.0	377.0	500.0	440.0	380.0
230	394.0	475.0	487.0	424.0	379.0	500.0	441.0	385.0
240	399.0	475.0	487.0	426.0	381.0	500.0	441.0	390.0
250	401.0	475.0	487.0	428.0	384.0	500.0	440.0	392.0
260	403.0	475.0	487.0	430.0	386.0	500.0	440.0	395.0
270	406.0	475.0	487.0	433.0	387.0	500.0	441.0	397.0
280	408.0	475.0	487.0	432.0	389.0	500.0	439.0	397.0
290	410.0	475.0	487.0	436.0	389.0	500.0	439.0	399.0
300	410.0	475.0	487.0	436.0	389.0	500.0	439.0	399.0
310	410.0	475.0	487.0	436.0	389.0	500.0	439.0	399.0
320	410.0	475.0	487.0	436.0	389.0	500.0	439.0	399.0
330	410.0	475.0	487.0	436.0	389.0	500.0	439.0	399.0
340	410.0	475.0	487.0	436.0	389.0	500.0	439.0	399.0
350	410.0	475.0	487.0	436.0	389.0	500.0	439.0	399.0

(a) Analysis unit legend:

1st digit = stand status (existing natural=1, managed=2, road right-of-way=8, not Crown forest=9);

2nd digit = species group (fir dry=1, fir wet=2, cedar=3, hemlock=4, spruce predominant=5, spruce mixed=6, pine=7, deciduous=8, not grouped by species (non-forest, non-contributing forest or backlog)=0);

3rd digit = productivity rating (upper range (good)=1, mid range (medium)=2, lower mid range (medium) or lower range (poor)=3, lower range (poor)=4, backlog 1=5, backlog 2=6, not rated=0).

Appendix B

Socio-Economic Analysis Background Information

B.1 Definition of Forest Industry Activities

Harvesting and employment information provided in the previous Timber Supply Review socio-economic analysis and Ministry of Forests' annual mill survey were used to develop employment coefficients. These coefficients can be used to provide an indication of the rough order of magnitude of forestry employment associated with current and future timber harvest levels in the forestry sector. Such coefficients are subject to considerable change over time due to a number of factors. Over the past several decades, technological change and industry consolidation have resulted in declining employment coefficients for timber harvesting and primary processing, while employment in harvest planning and value-added processing have increased. For purposes of analysis, the forestry sector has been divided into three sub-sectors:

- harvesting and related employment;
- silviculture and related employment; and
- processing employment.

Harvesting employment

Harvesting and other woodlands-related employment such as log salvage, log scaling, and harvest planning and administration (activities in log hauling and road building and maintenance are counted as indirect employment i.e., in multiplier estimates). In recent years, there has been an increase in pre-harvest planning and the volume of timber harvested by innovative means such as helicopter logging, driven in part by increasingly stringent environmental regulations and the need to harvest in less accessible areas. Timber harvesting (including employees who work in the harvesting operations of a forest company and those working as contract loggers) is the most strongly linked component of the forest industry to harvest level changes.

Silviculture employment

In the Golden TSA, major licensees are responsible for basic silviculture (e.g., planting and surveying) on areas harvested under major licences. The provincial government is responsible for enhanced or intensive silviculture (e.g., spacing, fertilizing and pruning) and the remaining basic silviculture on Crown land. The silviculture employment component is not as strongly linked to harvest level changes because of the time lag between when harvesting takes place and replanting begins, and because enhanced activities are concentrated on areas previously harvested.

Timber processing employment

Primary timber processing includes a number of products such as lumber, veneer and plywood, log homes, poles and posts, shakes and shingles, and pulp and paper. Secondary or value-added processing includes products such as remanufactured products, engineered building products, millwork, cabinets, and furniture. Historically, technological change, consolidation of regional processing capacity and the increase in value-added processing have been important factors affecting timber-processing employment coefficients. The timing and magnitude of timber harvest changes on the processing sector can vary depending on factors such as availability of alternative supplies, adjustments in capacity utilization and minimum economic production levels. The linkage between harvest level and value-added products, which use lumber as an input, and pulp and paper products which use sawmill waste, is weaker than for activities such as logging.

B.2 Impact Coefficient and Multiplier Estimates

Direct impact coefficients

Employment estimates are reported in person-year equivalents, i.e., one person working for a full year. Since harvesting and silviculture activities are usually seasonal in nature, the number of jobs in these activities supported by the Golden TSA timber supply is greater than the number of person-years. Since timber processing is generally a year-round activity, the number of jobs is roughly equivalent to the number of person-years.

Survey data for harvesting and silviculture employment for the Golden TSA are not available. Therefore, harvest and silviculture coefficients used in this analysis are based on the coefficients estimated from the forest industry survey undertaken for the *Golden TSR Analysis Report* (1998). These estimates are based on 1994-1996 data and therefore do not reflect possible changes in factors such as harvest methods, technology and planning and forest management requirements. Processing coefficient estimates are based on Ministry of Forests' annual mill survey data and are estimated as total person-years divided by total timber harvest in the Golden TSA over the 1999-2001 period. The mill survey data may not capture small sawmills or value-added facilities. For harvesting and processing, the direct employment coefficients are applied to the current average harvest of about 405 000 cubic metres per year over the 2000-02 period to estimate current employment levels.

In the short to medium term, trends in factors affecting harvesting and processing are not likely to result in major changes in the employment coefficients, in part because such trends can be mutually offsetting. For example, increased requirements for pre-planning and more sensitive harvesting methods can partly offset the trend to harvesting mechanization. Also, the trend to labour-saving timber-processing technology could be partially offset by growth in the value-added sector.

It is assumed that the proportion of forestry employment supported by Golden TSA timber harvest is the same as estimated from the industry survey undertaken for the *Golden TSR Analysis Report*.

Provincial revenue coefficients include stumpage, royalties and rent payments from the Ministry of Forests, Revenue Branch. Estimates of tax coefficients for industry taxes such as logging, corporate capital, sales, property, electricity, and provincial share of corporate income, are based on PricewaterhouseCoopers' *The Forest Industry in BC*, for the years 1995-99, the most recent available. Employment income tax coefficients, including direct, indirect and induced effects, were derived from Canada Customs and Revenue Agency data available on the CCRA website. Industry tax coefficient estimates include only the provincial share of income taxes directly paid by forest industry firms and employees (i.e., do not include multiplier effects). On the other hand, these coefficients include some taxes (e.g., corporate capital and property taxes) that are not likely to vary with incremental changes in harvest levels. Total provincial tax revenues are estimated by multiplying the revenue coefficients by the average harvest level in the TSA over the 2000-02 period.

The strength of the linkage between these levies and changes in timber harvest levels varies by revenue source. For example, corporate capital and property tax revenues will not likely change unless there is a permanent mill closure or reduction in the value of the facility. Also, these are gross estimates that do not net out costs to the Ministry of Forests or government overall. Finally, these estimates assume that there are no alternative uses of capital or labour in the economy that will generate provincial revenue. It should be noted that these are estimates of gross revenues, and do not take into account management, administration and other public costs attributable to the forest industry in B.C.

Multipliers

Indirect and induced employment impacts at the TSA level are based on the mid-point of a range of multipliers for timber harvesting and processing estimated by BC STATS (1999). The upper limit of the range assumes that all displaced workers will leave the Golden TSA and will no longer spend any of their income locally. The lower limit assumes that employment insurance and other social assistance payments to displaced workers will encourage them to remain in the community.

B.2 Impact Coefficient and Multiplier Estimates

Provincial employment multipliers for timber harvesting and plywood processing are also based on a mid-point of a range of multipliers for the province as a whole developed by the Ministry of Finance and Corporate Relations (1996). As with regional multipliers, the upper limit of the range assumes that changes in the demand for labour are met solely by migration of workers into or out of the province, rather than through other adjustments such as changes in wage levels. These estimates do not reflect variations in provincial multipliers that may stem from regional factors (e.g. harvesting on the coast versus the interior), although these differences do not appear to be large.

Income multipliers are not calculated, but indirect and induced employment income impacts are estimated by multiplying indirect and induced employment by average earnings in these sectors.

Multiplier effects, particularly beyond the "first round" of impacts, are the least strongly linked to harvest changes of all the categories of impacts included in this analysis. This is because activity levels in affected sectors depend on business and worker spending from industries other than forestry.

